No. 1915 Vol. XLVIII SEPTEMBER 6th, 1945

FLIGHT

and

AIRCRAFT ENGINEER

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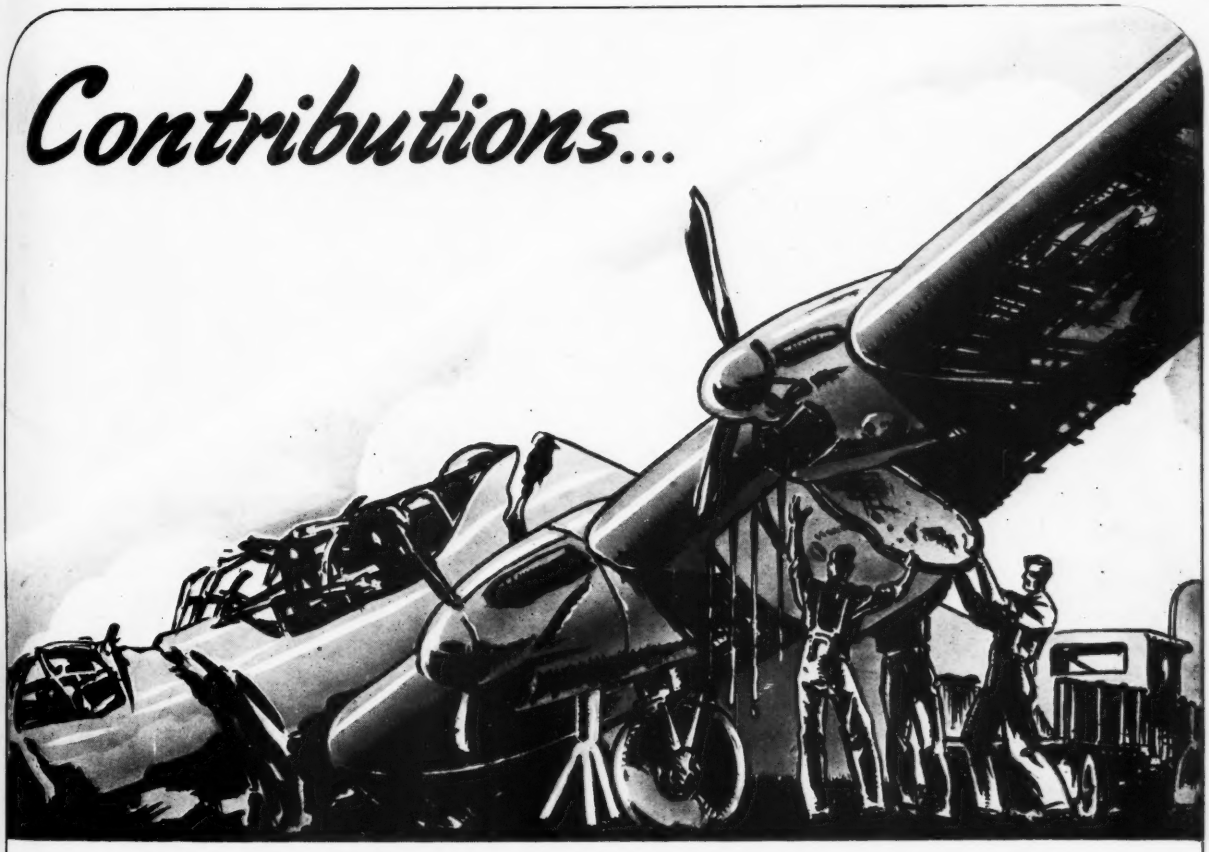

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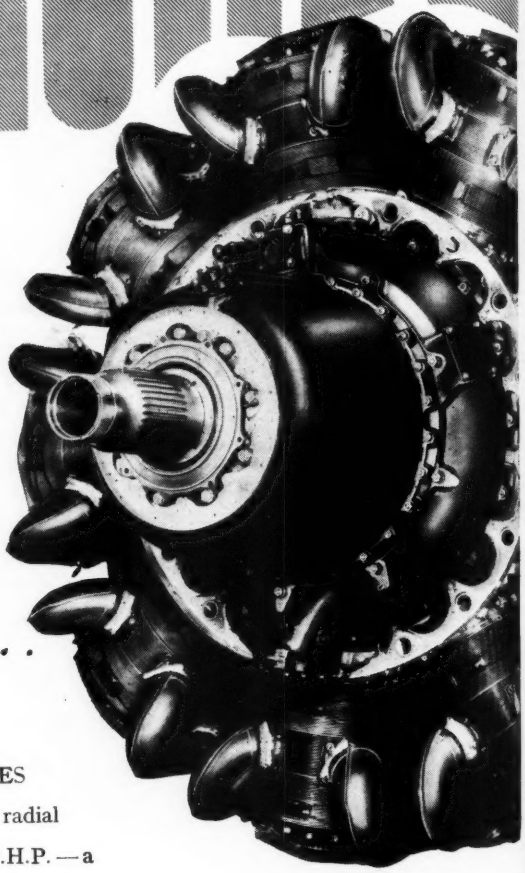

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THE BRISTOL AEROPLANE COMPANY LIMITED

FLIGHT
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AIRCRAFT ENGINEER

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

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The Outlook

The Tune Has Changed

AFTER the treatment meted out to the Air Training Corps during the last couple of years, the appeal issued by the Air Ministry is really rather funny, or it would be if it were not so tragic. Lads who, with a keenness beyond all praise, had joined the A.T.C. so as to qualify themselves for the Royal Air Force were bundled off into the Army or into any other square holes that could be found for these particular round pegs. That they had spent years on highly specialised training went for nothing. Bitter disappointment was the result, and the A.T.C. began to stink in the nostrils of thousands of youngsters who saw vanishing into thin air all the hopes they had built up—fostered, be it remembered, by promises made to them when they joined the Corps.

Admittedly this was unjustified inasmuch as the A.T.C. and Air Ministry had not the power to refuse to let their lads be transferred to the Army, but the cadets could hardly be expected to differentiate between their own authorities and those "still higher up." To them it seemed very naturally that they had been shabbily treated, as indeed they had, their patriotism and keenness in joining the Corps voluntarily being rewarded, as they saw it, by bundling them willy-nilly into the Army, where they worked alongside boys who had done no pre-entry training but merely waited until they were "fetched."

And now the Air Ministry is appealing to former members of the R.A.F., officers and airmen, to come forward and volunteer for posts as officers and instructors in the A.T.C. If they don't, "the position is being reached when there will not be enough qualified men to give proper instruction to existing cadets—or to the thousands of young men who are still joining the A.T.C. eager to learn about the air." That is really rather priceless.

"Stratovision"

THE experiments which will presumably be made in the United States of America as a result of the schemes propounded by the Westinghouse Electric Corporation and the Glenn Martin company for transmitting television programmes from aircraft should be watched with great interest in this country. (Details are published in this issue.)

True, American conditions are very different from ours. We have not the vast distances to cover which the American continent presents, but, conversely, one or two aircraft circling at 30,000 or 40,000ft., carrying transmitters and relays would probably make it possible to cover the country from Land's End to John o' Groats and from Northern Ireland to the Wash.

The Glenn Martin company does not appear to be in the least worried by the aircraft technical problems, which their engineers describe as "nut and bolt problems." While the Americans are proposing to build specialised aircraft for the work, we could probably adapt existing bombers, of which there will be plenty to spare, and thus save a good deal of time.

The cost per aircraft would probably be greater in this country than in America, due to the higher price we have to pay for fuel, but even so, the expense involved in keeping a couple of aircraft in the air during television hours, with two more in reserve, should not be altogether prohibitive. Significant is the fact that the originator of the scheme, Mr. C. E. Nobles, has stated that a transmitting power of one kilowatt, using valves existing and available to-day, suffices for a range of 200 miles in all directions, "even for the high-definition colour television frequencies." The picture thus conjured up is a tantalising one. High-quality television in colour! But this country has many bare necessities to find first.

The Sun That Has Set

AS we have remarked before, aircraft struck the first and the last blows in the war between the United Nations and Japan; but their functions did not cease with the obliteration of Nagasaki. Airborne troops were the first to set foot on the soil of conquered Japan, and General MacArthur, the Supreme Commander whose authority overrides that of the Heaven-descended Emperor Hirohito, also arrived by air.

An aircraft landing is often an interesting and sometimes a charming spectacle, but one must confess that it is not so imposing as an army disembarking from a fleet of transports and forming up for a march into the conquered country. That spectacle was also witnessed in Tokyo Bay.

The Japanese as a people are army-minded, which is strange for an island kingdom, and the march of a conquering army through their capital was necessary to bring home to them the completeness of their defeat. Finally, the formal act of surrender was signed on the deck of an American battleship; and so all three Services share in the humiliation of the foulest aspirants for universal power since the days of Changiz Khan.

But if the landing of the aircraft was not so spectacular as the naval and military ceremonials, there was none the less a special fitness in the arrival of General MacArthur in Japan by air. It will not be forgotten by the Japanese.

End of Censorship

THE censorship which has been in force since the outbreak of war in 1939 has ceased. That fact will have been fairly obvious to readers of the dailies. Our own readers must not, however, expect from this immediate publication of full details of all the new aircraft and power plants the existence of which they may have suspected. The three Services must still exert a certain amount of control over what may be published. That is but natural, and with it neither we nor our readers will quarrel.

It may come as something of a surprise to many of our readers to learn that throughout the war the submission of written matter and illustrations has been voluntary. Editors were not compelled to submit, but as a matter of course they did submit anything which seemed in the least doubtful.

We on the editorial staff of *Flight* always followed the policy of asking ourselves whether any particular article or item could possibly help the enemy. If we decided it might, we refrained from publishing. On the whole, we made few mistakes, and we should like to take this opportunity of thanking the staff of the censor's department. We have not always seen eye to eye with them on matters of secrecy, but we have always met unfailing courtesy in the department, and they have always been very willing to listen to our side of the argument.

Nevertheless, we are glad to be free of censorship and so, we imagine, are the censors. They had a rather thankless task.

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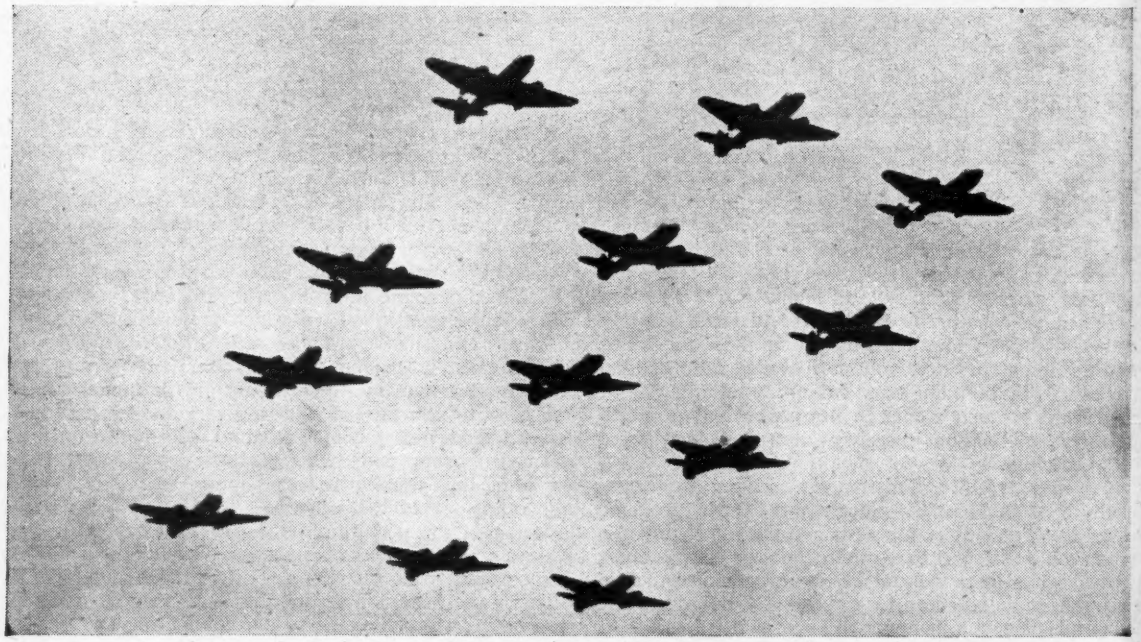
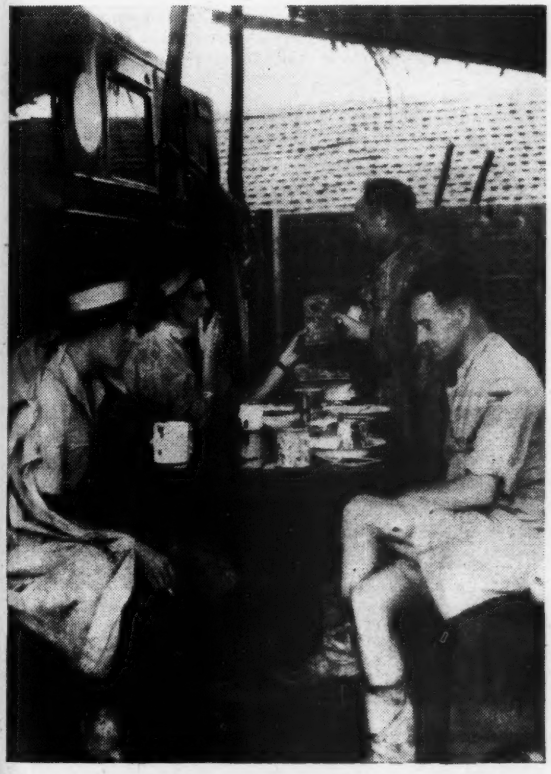


IN JETS ASTERN: Gloster Meteors from a jet fighter station—No. 616 and 74 Squadrons—show that tight formation—flying is still possible despite the blowlamp effect.

R.A.F. Spitfire pilots, back from the Sittang River, make their way across an airfield flooded by monsoon rains.

Jungle Maintenance

Sisyphus Task of R.A.F. Ground Crews in Burma : Working in 150 deg.F. Inside Aircraft : Abnormal Expansion in Heat : Corrosion Overnight in Monsoon



On the Arakan front. Airmen wearing monsoon kit try to find a drier spot for meals.

IN drenching monsoon rains, and in shade temperatures of 120 deg. F., R.A.F. ground crews in Burma have kept in operation aircraft that blasted the way through for the Fourteenth Army from Imphal to Rangoon. Theirs was the unglamorous job that only rarely hits the headlines. Theirs was a task that had to be learned from scratch. The R.A.F. had never before been forced to service and maintain aircraft based on what were airfields only in name. Frequently they were just earth strips rolled out of paddy fields or hacked out of jungle.

The maintenance crews moved along the 900-mile way to Rangoon with the squadrons as they leapfrogged forward; setting up bases on airstrips often captured less than 24 hours before. Forward, too, moved the servicing echelons, the second-line aircraft repair and salvage units, backed by the mobile aircraft equipment supply units. Sometimes the squadrons were preceded by detachments of R.A.F. Servicing Commandos, who handled the aircraft as they arrived on newly won bases and dealt with any Jap stragglers.

Jungle "workshops" were only that in name. Heat stroke and heat exhaustion killed a fair number of these ground crews and put many out of action. There were no hangars. Repair and inspection of aircraft had to be done in the open, seeking, wherever possible, the protection of jury-rigged awnings or trees. Trees were a mixed blessing. Leaves, twigs and insects had a habit of falling into partly stripped aircraft.

If, however, aircraft, tools and equipment were unprotected from the sun, they became too hot to handle. Cases were not unusual of men getting second-degree burns through touching exposed metal parts or tools. The

JUNGLE MAINTENANCE

Armourers, struggling through the monsoon mud, rearm a Spitfire bomber.

temperature inside an aircraft would rise to as high as 156 deg. F. in the heat of the day and work in them could be done only for a few minutes at a time. The temperature rose, too, far above the safety line for certain explosives and ammunition. Guns have fired owing to the ammunition "cooking off." In the wet season the reverse prevailed, and dumps flooded more quickly than the ammunition could be removed to dry ground.

In the hottest part of the year, beginning in February, units aimed to start work at dawn and stop between noon and 4 p.m. This, however, was seldom possible. "Operational necessity," which meant anything from keeping squadrons at strength to an impending move, applied most of the time.

On the Meiktila airstrip, used by R.A.F. squadrons before the Japs had been completely mopped up, it meant making the aircraft sufficiently serviceable to fly out before dusk—or burning them. For several days the enemy infiltrated at night, occupied the strip, and remained until they were driven out at dawn.

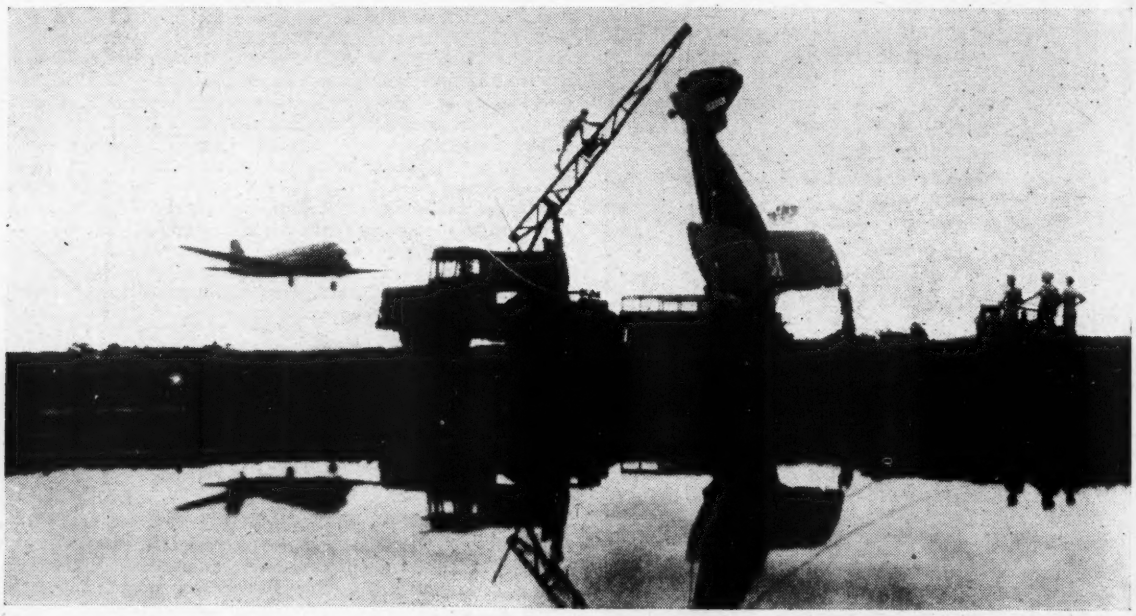
Extremes of heat and humidity were the cause of many servicing problems. Irritating troubles arose with spares and metal parts. Abnormal expansion would prevent bolts and rivets fitting; pouring petrol over them sometimes solved this problem. During the monsoon, spares became rusty overnight and precious time was spent servicing equipment that was listed as "ready for use."

Glued parts and laminations on wooden-fuselage aircraft and fabric or stressed skin on some types caused trouble. One or two types, in fact, which had proved notably successful in Europe proved troublesome in Burma.

Cyclone Damage

Sometimes when ground crews were working at full pressure a cyclone would strike the area. This might damage as many as 50 per cent. or more of the parked aircraft. First would come the wind, swirling the dust and sand under cowlings and into engines. As it increased in intensity aircraft would be uprooted from their moorings and nearly every tent in the vicinity would be flattened. Torrential rain would soak everyone's bedding and kit and turn the camp into an ankle-deep quagmire. Not only would days of work be undone in an hour, but the unit would for a long while afterwards be piecing together damaged equipment and drying sodden sleeping gear, as well as sorting its records and papers out of the chaos.

In the monsoon work had to stop and the aircraft



Salvaging an aircraft which had been turned over when the monsoon swept over a forward airfield in Burma.

JUNGLE MAINTENANCE

covered with whatever was available. Even then covered aircraft suffered from the splashing of the downpour. Nothing could afford protection from the effect of water vapour steaming up from the ground.

Crews had to move warily when lifting cowlings and stripping aircraft; scorpions and centipedes in Central Burma habitually settled in the many niches that aircraft engines and fuselages have to offer. Snakes curled up under cowlings and in cockpits. One test pilot was attacked by a snake when flying at 5,oooft. He was wearing gloves and, though the snake struck twice, it did not penetrate. The pilot killed it. Tropical birds, also, simply could not be discouraged from building nests in the gun bays when guns were removed for maintenance.

In a land campaign decided by air supply, aircraft spares, including aircraft engines, had for the most part to be flown in. Engines or aircraft beyond the repair capacity of the mobile servicing units had to be flown out or broken down and the serviceable parts salvaged to make good other aircraft.

A regular flow of all types of aircraft engines—serviceable forward and repairable back—was part of the Dakota supply service. What would not fit inside was slung underneath the aircraft. A supply squadron specialising in carrying maintenance requirements to jungle airstrips inaugurated what their Canadian personnel called "The Valley Hop." A Dakota would go forward and move between units and repair units, noting what each was requiring most urgently and what each had to spare. The Dakota then began a shuttle service, ultimately reaching the point where the best redistribution of requirements was made and a few more aircraft would be made serviceable.

So, for more than a year of constant shifting and changing, of treks over mountains and through jungle, up hills where men followed the crawling lorries with wheel chocks ready, the maintenance units moved, settling on strips for a month, for a week, sometimes only for days, as the Japanese retreat went on.

They never let up on the job. They are to-day still keeping the Spitfires, Mosquitoes and Thunderbolts flying. A great achievement.

Bomber Harris Retires

Famous Chief Leaving Service : Deputy Chief of Staff Takes Over

AFTER holding the appointment for over 3½ years, and carrying the responsibility for the biggest bombing campaign of the war, Air Chief Marshal Sir Arthur T. Harris, G.C.B., O.B.E., A.F.C., is to relinquish command of Bomber Command this month. He is expected shortly afterwards to retire from the Royal Air Force. For his outstanding services in building up and operating the Royal Air Force bombing offensive against Germany he was awarded the G.C.B. in the last Honours List.

Before becoming A.O.C.-in-C. Bomber Command Sir Arthur went to America in charge of the Royal Air Force delegation and, previously to that—from November, 1940, to May, 1941—he was Deputy Chief of Air Staff. He went to the Air Staff after commanding No. 5 (Bomber) Group.

Sir Arthur started his military career in the ranks in 1914 when he enlisted in the 1st Rhodesian Regiment, with which he served in German West Africa. In 1915 he returned to England and was granted a commission in the Royal Flying Corps. He served in France and with home defence squadrons and was awarded the Air Force Cross in 1918.

By 1921 he was commanding No. 31 Squadron in India; afterwards having charge of No. 45 Squadron in Iraq. Then followed a variety of appointments and experience. Returning to England in 1924 he took a Senior Officers' course and later commanded the first post-war squadron to fly heavy bombers at night. At Camberley, in 1928, he passed the Army Staff College and then went to the Middle East for a further tour of duty abroad. Returning to England in 1932 he took a flying-boat pilot's course at Calshot. By the following year Sir Arthur became Deputy Director of Intelligence, and in 1934 became Deputy Director of Plans.

His first Group command—No. 4 (Bomber)—came in 1937. He held this for quite a short period, for in 1938 he was A.O.C. R.A.F. in Palestine and Transjordan. Sir Arthur Harris is now only 55 and it is to be hoped that he will give the nation many more years of service in some other capacity.

Air Chief Marshal Sir Arthur Travers Harris, A.O.C.-in-C. Bomber Command R.A.F. from February, 1942 to September, 1945.

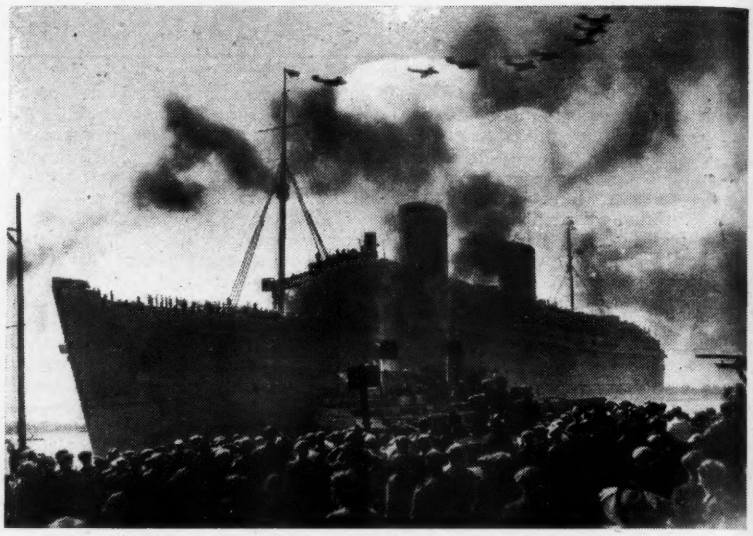
Air Marshal Sir Norman Bottomley, K.C.B., C.I.E., D.S.O., A.F.C., who is at present Deputy Chief of Staff, will succeed Sir Arthur as A.O.C.-in-C. Bomber Command. Air Marshal A. Durston, C.B., A.F.C., will leave the Group which he now commands in South-East Asia, and will take up the appointment of Deputy Chief of the Air Staff.

Other Changes in Higher Command

Air Marshal Sir Charles R. Carr, K.B.E., C.B., D.F.C., A.F.C., who succeeds Air Marshal Sir Leslie Hollinghurst, K.B.E., C.B., D.F.C., as Air Marshal Commanding, Base Air Force. South-East Asia, took up his new duties on August 22nd. Sir Leslie has been selected for the appointment as Air Council Member for Supply and Organisation. Air Marshal Sir John S. T. Bradley, K.C.B., C.B.E., is relinquishing his appointment as Deputy Member for Supply and Organisation and will retire from the Service. The post will then lapse.

Air Vice-Marshal Sir Hugh W. L. Saunders, K.B.E., C.B., M.C., D.F.C. and Bar, M.M., is to be Air Marshal Commanding R.A.F. Burma. As his decorations show, Sir Hugh, a South African, has had a splendid military career since joining the 10th Witwatersrand Rifles in August, 1914. In this war he has been seconded for special duty with the New Zealand Government from 1939 to 1942 and came home to become A.O.C. Headquarters No. 11 Group, Fighter Command. For a while he was Director-General of Postings.

HERE AND THERE



FARES, PLEASE ! : R.A.F. aircraft salute the departure from Southampton of the *Queen Elizabeth* with 16,000 U.S. troops aboard. As reverse lend-lease it would have been a free passage, but now——?

Valuable Collection

A COLLECTION of air mail stamps was recently sold in London to a private collector for £6,250. It included a special stamp issued by the Newfoundland Government in 1919 for a letter carried by Sir Harry Hawker and K. McKenzie-Grieve on their unsuccessful transatlantic attempt.

Traveller's Tribute

A TRIBUTE to the "enormous development" of the Canadian aircraft industry was paid by Mr. R. W. Sutton, a director of Dowty Equipment, Ltd., when he described to the firm's workers at Cheltenham his nine-weeks' mission to Canada, the U.S. and the West Indies. The trip, sponsored by the British Air Commission, covered 33,000 miles by air, the outward flight being by the South Atlantic route.

Veering Westwards ?

AVIATION experts in Toronto have expressed the opinion that Canada will become the aircraft production centre for the British Empire within the next decade.

Hawker Siddeley's recent purchase of the Victory aircraft plant at Malton is taken as an indication in this direction, and it is thought likely that Rolls-Royce will establish a factory in the Dominion to build engines for Canadian aircraft.

Nerve !

HAVING handed the Air Training Corps the sort of shabby deal of which only a government department is really capable, the Air Ministry is now appealing to the patriotism of demobbed officers and airmen of the R.A.F. to come to the rescue by volunteering to serve the Corps as officers or instructors "to relieve those older A.T.C. officers who have served the Corps throughout the war and who *for various reasons* are unable to continue the good work."

The italics are ours, for the main reason, as we know from first-hand experience, is that so many of them are too disgusted and disheartened to continue now the war emergency is over.

The Editor has something to say about it on the leader page this week.

U.S.A.A.F. to be Reduced

ACCORDING to a Washington spokesman at a recent Press conference, the strength of the U.S.A.A.F. is to be reduced, by next July, from its present 2,150,000 men and 65,000 aircraft, to 600,000 men and about 8,000 aircraft.

The lower figure is regarded as "the irreduceable minimum," and will be capable of rapid expansion if required.

"The changing world situation, peace status, or the possible assumption of a police task being undertaken by the United Nations," added the U.S.A.A.F spokesman, "may alter the present expectation."

Closer Link-up

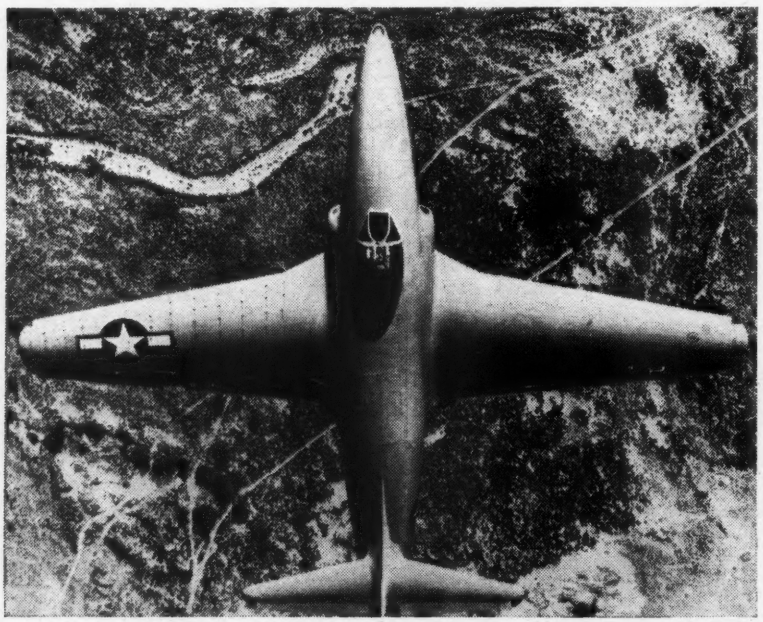
THREE Hawker-Siddeley nominations, Sir Frank Spriggs (chairman), Sir Roy Dobson and Mr. H. K. Jones, have been appointed to the board of High Duty Alloys, thus indicating a closer link-up between producer and user.

Mr. H. G. Harrington, a member of the old board, has been appointed controller, and Mr. Duncan McKellar, of Thomson McLintock, is retiring; he was Hawker-Siddeley representative on the old board.

Fifth Anniversary

SQUADRONS of R.A.F. Fighter Command and Coastal Command will make a demonstration flight over London and its outskirts (weather being suitable) on Saturday week, Sept. 15th, the fifth anniversary of one of the greatest air fights in the Battle of Britain, and on the Sunday there will be special parades and thanksgiving services throughout the country.

The service at Westminster Abbey will be preceded by a parade in which contingents of aircraft workers, representa-



SHEEP'S CLOTHING : Despite laminer flow aerofoil and "fastest ever" speeds the port wing of this Shooting Star shows that something can still be learnt from the old-fashioned wool tufts plainly seen on its upper surface.

HERE AND THERE

tives of A.A. Command, the Home Guard, and units of the Dominion and Allied Air Forces as well as all the Home Commands of the R.A.F., including men who took part in the Battle of Britain, will march from Wellington Barracks to the Abbey.

Nearly 100 R.A.F. stations in various parts of the country will be opened to the public on Sept. 15th and visitors will be able to see various types of Service aircraft and equipment and to inspect workshops, stores, barracks, messes, recreation rooms and so forth.

Museum Piece

THE first jet-propelled aircraft to be built in America, the Bell P-59 Airacomet, has been placed on permanent exhibition in the Smithsonian Institution, Washington.

As far as is known, P-59s were never produced in numbers, and never went into action. The Airacomet is the only modern aircraft in the aircraft section of the Institution.

Changing Over

REUTER reports that in a statement quoted by Melbourne radio last week, Mr. John Storey, of the Department of Aircraft Production, said that at least 30,000 Australian aircraft workers would be discharged with the return of the industry to a peacetime basis. The permanent aircraft industry, he added, would employ only 10,000 workers. The production of jet-propelled aircraft would "almost certainly be continued."

The New Geography

A SERIES of six talks under the title of "The Geography of the Air" are to be given in the B.B.C. Light programme by S. W. Wooldridge, J. F. Horrabin and D. L. Linton, who will deal with a wide range of topics such as the atmosphere, weather, climate, air routes, and the use of aircraft for mapping, archæological investigation and so forth.

The first three, on September 8th, 15th and 22nd, will be given by Mr. Wooldridge, who will deal with flight and weather, and the time is 10.40 a.m. in each case—not too convenient an hour for listeners, even on a Saturday.

Casablanca

BEFORE the war, the precise location of Casablanca was probably known to few Britons except the bright lad who was top in geography. Now it is almost as familiar a name as Brighton or Birmingham, though it would perhaps be difficult to say whether Winston Churchill or Humphrey Bogart is chiefly responsible for this improvement in our education.

At the present moment it is the jumping-off point for the Skymasters engaged in flying U.S.A.A.F. personnel home across the Atlantic, and the lucky men are flown there from France in ex-operational Flying Fortresses still manned by their veteran combat crews.

On their return trips from Casablanca to France, the Forts bring back French refugees who had fled to French Morocco in 1940, and more than 8,000 of them have already been ferried home in this speedy fashion.

Combat equipment has been removed from these B-17s and seats fitted in the nose, bomb bay and waist, so the journey is reasonably comfortable.

Credit Where Due

LAST week we described a Beechcraft Expediter which has been specially prepared for the personal use of Vice-Admiral Sir Denis Boyd, chief of the Naval Air Service.

By some extraordinary oversight the name of the company which undertook the work was omitted. It is Southern Aircraft, of Gatwick, who have done and are doing a great deal of this kind of work for the Admiralty, and who certainly deserve full marks for the very high quality of workmanship and finish put into the Expediter.

Group Officer Felicity Hanbury, M.B.E., appointed Senior W.A.A.F. Advisory Officer, R.A.F. Middle East. She was previously W.A.A.F. Staff Officer at an R.A.F. Signals Group H.Q.

News in Brief

THE sudden ending of the Japanese war, it is reported from Ottawa, will mean the winding-up of the majority of British air training programmes at various Canadian air stations.

* * *

The Empire Air Navigation School and the R.A.F. maintenance unit at Shawbury, Salop, were recently opened to the relatives of personnel there on the occasion of a garden party and show held on the station.

* * *

Mr. Halam R. Haerle and Mr. Phillip Love have recently joined the staff of the Haywood Compressor Co., Ltd., Redditch, in the posts of technical sales manager and research manager respectively.

* * *

The first "Amy Johnson" scholarship has been awarded by the S.B.A.C. to Miss Dorothy Gwynne, an 18-year-old Coventry draughtswoman who will soon start her four to five year course in aeronautical engineering. She will be the first girl apprentice aircraft engineer and is the first girl in Britain to be granted such a scholarship.

* * *

One of the oldest members of the W.A.A.F., 60-year-old L.A/C.W. Florence Eleanor Downham, was among the Service women who attended the National Thanksgiving Service at St. Paul's Cathedral on Sunday, August 19th. She and Section Officer T. Turner were representatives of Coastal Command.

* * *

Printed specification leaflets of the Cirrus Minor and Cirrus Major range of aircraft engines are now available to representatives of flying clubs, training schools and aircraft operating companies as well as to manufacturers.

* * *

The Aircraft Club, Harrogate, wishes to contact those in the district who are interested in gliding, particularly those with previous experience. The club would also like to hear from those, in all parts of the country, who are keen on the designing, building and flying of small, low-powered aircraft.

* * *

Mr. W. E. Prytherch has relinquished his position as technical director of High Duty Alloys, Ltd., and intends to act as an independent research consultant. He will, in particular, act in that capacity to the group of companies which Col. W. C. Devereux is now forming.

* * *

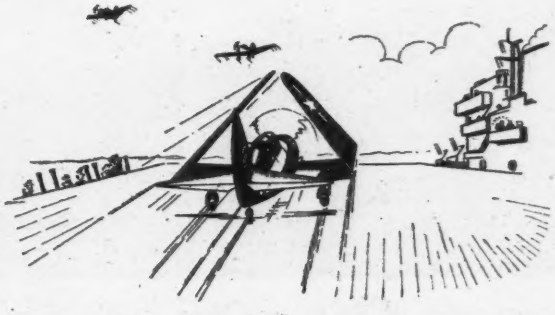
David Brown and Sons (Huddersfield), Ltd., have opened an area office at 109, Pilgrim Street, Newcastle-upon-Tyne. Tel. 20902; telegraphic address, "Gearing," Newcastle-upon-Tyne.

* * *

New three-storey premises have been opened by Specialloid, Ltd., at 289, Deansgate, Manchester. Their telephone number remains unchanged.

* * *

Having resigned from British Timken, Ltd., Mr. P. A. J. Linforth is joining Silentbloc, Ltd., and will be concerned with technical and commercial developments in the Midlands.



"Hello, Navy 123. Hello, Navy 123. Kinda eager—ain.cha?"

Bomber's Radar

General Survey of the Three Primary Systems Used by Bomber Command

By C. B. BAILEY-WATSON

SO much has recently been published about radar since the security restrictions were alleviated that the subject is, on the surface, fast becoming hackneyed. However, up till now, no description has been given of the operational use of the three main systems used by R.A.F. Bomber Command, although the code name titles of the systems, Gee, Oboe and H2S, were recently released.

Readers of *Flight* will by now have gained a fairly good insight into the basic fundamentals of radar from the articles which have already appeared from time to time, and, in view of this, we are here going to deal only with what happens in operation and with the way in which the systems are used.

First, it is worth while going back to the early days of the war in order to gain some appreciation of what bombing conditions were originally like, when the crews were doing their best to cope in spite of having no especial aids. In 1940 there was only one group (equipped with Whitleys) in Bomber Command which was trained for night operations; however, all the remaining groups were fairly quickly trained, and, as time went on, bombing was increased. Nevertheless, it was ascertained that, despite good reports, the average of hits on the targets was little more than 3 per cent. of the total dropped.

During the latter part of 1941 efforts were made to plan raids with a degree of accuracy, and, as a help, the Boffins (civilian scientists) were working flat-out to give the bomber crews accurate navigational aids. The first of these was Gee, and its first great success was the famous 1,000-bomber raid on Cologne on May 31st, 1942, when 1,700 tons of bombs were lifted and 30 per cent. were recorded as target strikes: an increase in efficiency which paralleled the size of the raid. In this spectacular and pioneer foray between 300 and 400 aircraft equipped with Gee were included in the main force of 1,000.

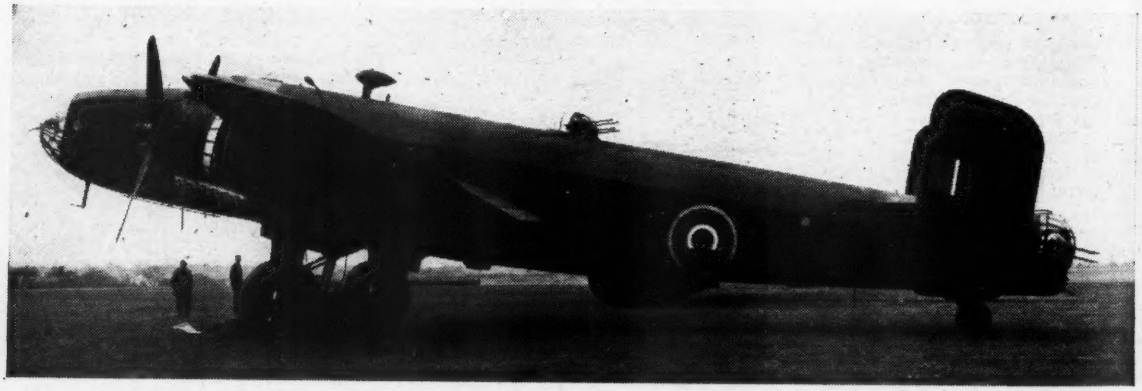
It must not be thought that Gee is a bombing instrument or system; it is purely a navigational aid by means of which the aircraft's position may be determined at any time to a fairly high order of accuracy. Briefly, the system comprises ground stations in this country which are constantly transmitting sheets of radio signals, which emanate in hyperbolic lines of individually constant signal strength over a wide area. As the separate lines of signals from, for example, station B intersect the lines of signals from station C, and as the position of each individual signal line is charted and given a number, by learning from the Gee set in the aircraft which intersection of lines obtains, reference to the chart will give the exact position of the machine.

On the cathode screen of the set are two fluorescent scales, horizontally one above the other, and both are bounded at the left end by a datum "spike" known as the A marker. Each scale is calibrated in divisions of five, the top scale being for B signals and the bottom for C signals. On these scales appear "traces" or "spikes," together with little patches of light which are called "strobes," and the operator must tune-in on his controls to bring the strobes directly beneath the trace spikes. The number of divisions from the datum A marker to the spikes are then counted and, shall we say, give whole numbers of 40 for B scale and 130 for C scale. When this is done, a switch is turned to give great magnification of the scales and traces, and the decimal fraction part of the number can then be determined. For example, we will assume that the readings obtained are B=40.74 and C=130.35. All that the navigator has then to do is look at his Gee map on which all the signal lines are printed, find where B 40.74 and C 130.35 intersect, and that is the position of the aircraft. To aid him further, B lines are printed in red on the chart and C lines in blue.

Two Miles or Less

This, then, is Gee, which, from this country, would get an aircraft to its target in Germany within an accuracy of two miles, which, however, could be bettered by a first-class operator. Needless to say, as with all radar systems, visibility or general weather conditions have no effect upon its operation. Probably the greatest advantage to aircrews was the use of Gee for homing, and for this very pleasant application the intersecting signal values at base are determined, the B signals, for instance, set on the screen, and then all the pilot has to do is fly along the particular B signal line until both the B and C signal strobes show up directly beneath the A marker. The aircraft is then directly over its base.

Following Gee, the next radar system introduced was Oboe and, to the lay observer, it is the most amazing of all. Oboe was first used by the Pathfinders to mark Essen in March, 1943, for the main bombing force. Until this raid, Bomber Command had lost 368 aircraft in attacking Krupps, but the six Pathfinder Mosquitoes which, on Oboe, dropped 24 target indicators to mark Krupps for the main

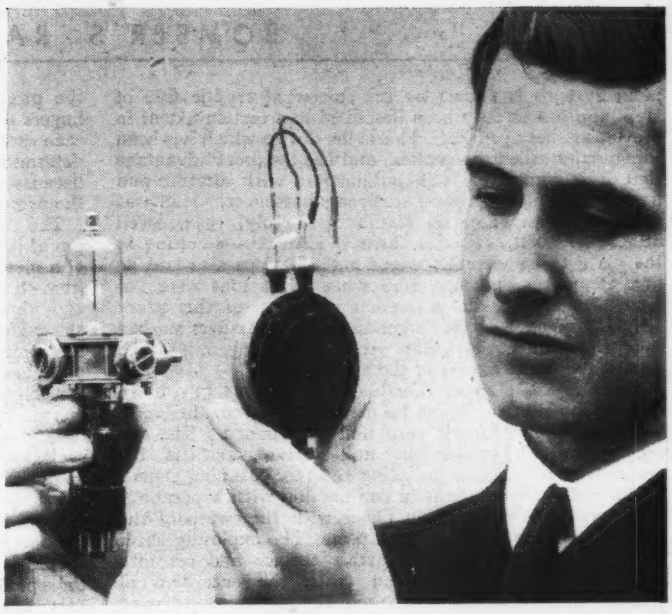


The blister on the belly of this Halifax is where the H2S scanner is housed. Usually, the rear end is Perspex although, as above, in some cases this does not apply.

bombing force enabled no less than 83 per cent. of the bombs lifted to be registered as on-target strikes.

It is of interest to record that the advent of radar made the magnificent work of the Pathfinder Force possible and, consonantly, the wonderful efficiency of our bombing attack. When the P.F.F. Mosquitoes ground-marked a target the name given to the operation was Parramatta, and when the uncanny system of sky-marking was used, the operation was called Wanganui. Both these types of target marking are "blind," that is, they are done on radar, but when the Oboe system was used the word "Musical" was added to the title. "Newhaven" was the name of another system of target marking which included both visual and blind marking. It is unfortunate that space forbids our dilating upon these intriguing types of operation; nevertheless, the radar part of the job is in itself of more than passing interest.

Oboe makes use of two ground stations, one in Norfolk, the other in Kent, the former being known as the "releasing" station and the latter as the "tracking" station. The tracking station transmits a component of a signal beam which runs as a segment of a circle through the target, the radius of the circle being the distance of the target from the tracking station. The remaining component of the signal beam is supplied by the aircraft equipment. Signals are purely aural, there being no visual representation whatsoever; the pilot and navigator each receive signals through their earphones, the pilot's being high pitched, the navigator's low. Each has his own set of signals and consequently the bombing or marking operation is a conjoint effort.



The two revolutionary valve elements which made all the difference to transmission. The brass valve on the left is the receiver valve and the other is the magnetron.

Very Narrow Beam

We will take the pilot's signals first. Initially, the aircraft must be flown to a waiting point at one end of the beam, and this can be done either by orthodox navigation or by flying on a W/T beam from this country. Having arrived at the waiting point Oboe is switched on and the signals heard. These are the morse T (−) and the morse E (·) which, when overlapping, give a continuous note in the earphones. The overlap zone is only 17 yards wide and so it may be appreciated that pretty accurate flying is needed to keep the continuous note from breaking down into dots or dashes, as deviations from the curved path of the beam will bring about.

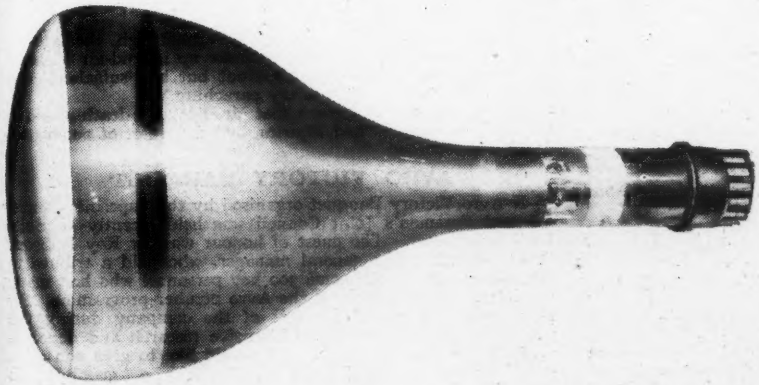
Subsidiary beams, concentric with the main beam, are spaced at 5-, 10- and 15-mile intervals on both sides, and as these give signals of X, Y and Z respectively over and above the dots and dashes making up the main beam, the pilot will know his position with a fair degree of accuracy if he should, by some mishap, be late in getting to the waiting point.

As the aircraft flies along the beam it transmits signals which are received at the releasing station and, consequently, as its range is steadily increasing from the releasing station, it is possible to plot, at the latter, the exact position of the aircraft at any one instant. It is, of course, absolutely essential that, once on the beam, the pilot flies his aircraft at a constant height and fixed air speed. He must on no account vary these factors.

Having, for example, switched on the system at the waiting point, we will now follow the aircraft along the curved path of the beam which leads across the target—the pilot keeping the continuous high-pitched note coming through. The navigator is sitting there listening and, at 10-minutes' flying time from the target, he hears four morse As which are followed by a continuous low note until, at 8 minutes from target, he gets four Bs. When 5 minutes away four Cs come through, again followed by the continuous note which breaks at 3-minutes' distance to four Ds. After this the continuous note comes through until only 5 seconds away from the target, when five pips are heard for 2½ seconds followed by a 2½-second dash. The navigator has the bomb-release button in his hand and, as the 2½-second dash ends, he presses it and the bombs have gone. Immediately the set is then switched off and the aircraft heads for home.

This, however, is not the end. At the releasing station a graphic record of the run has been made automatically, and when the crew get back it is *they* who are told how they have performed. It is no good them saying they were bang on when they can be confronted in black and white with evidence that they were, in fact, 50 yards off.

The third of the Bomber Command



A cathode-ray tube, on the convex silvered end of which the fluorescent trace or image is registered.

BOMBER'S RADAR

radar systems is known by the somewhat cryptic title of H2S, and has already been described to a certain extent in previous issues of *Flight*. This is the device which has been colloquially called the genbox, and has the great advantage that it is completely self-contained in each aircraft and has no relation to ground stations whatsoever. H2S was first used with effect on Hamburg in July, 1943, seven attacks—four R.A.F. and three U.S.A.A.F.—resulting in the place being virtually wiped-out. Krupps also had its final demolition through H2S when 5,000 tons were unloaded at 2.30 in the afternoon in March of this year; 10/10 cloud covered the target and the Pathfinders marked it with smoke puffs (a day version of Wanganui) which guided the bomb aimers of the main force.

What makes H2S so valuable is that, being *in toto* an aircraft installation, it can be used anywhere in the world —furthermore it cannot very well be jammed. The aircraft carries the transmitting and receiving stations, the transmitter emitting a pulsating sheet of scanning signals downwards and outwards in conjunction with a parabolic "mirror" which rotates in phase with the sweep of the scanning signals at about 50 r.p.m. The exploring sheet of signals impinge on the earth's surface and set into oscillation everything thereon (with the exception of water), the oscillation so caused thereupon re-radiating into space a fraction of energy. This minute amount of energy is received back at the aircraft and amplified to give a pictorial representation on a cathode-tube screen.

These ground returns, as they are called, appear on the screen in greenish patches, but any regular solid in the form of a factory, for example, will ensure a good-quality return and will appear on the screen as a lighter green patch. As water gives no return at all, a coastline or river will appear on the screen as a sharply defined dark area, and a town will appear as a patch of lightish green of a shape approximating to the actual shape of the town, although no really accurate degree of definition is possible.

On the screen a "spoke" light-band extending from the centre (which represents the aircraft's position) to the periphery sweeps round the screen at the same speed as the sweep of the scanning signals, that is, 50 r.p.m. The ground returns given on the screen are brought about by the passage of the spoke and fade after it has passed, but the properties of a fluoroscope are such that the image lingers and is, of course, regenerated approximately once each second so that the shape and position is fairly readily determined. This system is not very good at low altitudes because the ground returns are then so intense as to make the perception of any one particular feature rather difficult.

The range swept by the scanner can be varied, and a pip of light on the spoke band can be aligned on the image of a given town in order that the distances of the aircraft from that town can be read off against a scale. Additionally, there is a second spoke which does not sweep round although its radial position on the screen is determined by the aircraft's heading. In conjunction with this, a glass plate is fitted over the screen and engraved on its surface is a diametral gridline. This plate has a serrated edge and has degrees of arc marked around its perimeter, and in order to obtain the bearing of a town relative to the aircraft, the bearing spoke of the screen is brought over the image of the town and the gridline turned until it is coincident with the bearing spoke. The bearing of the town relative to the aircraft's head is then read off the graduated scale on the gridplate.

H2S is not normally operated by the navigator, but is the special concern of another crew member, called, in Service parlance, the "box-basher," whose job it is to give the navigator the information the latter requires. The box-basher's job is by no means an easy one, and it is easy to understand that, after sitting for hours peering at a dim, flickering screen, he should climb out of the aircraft and totter into the interrogation officer feeling somewhat dopey and with puffed-up, bloodshot and aching eyes.

If the descriptions of the wonders of radar systems and the enormous aid they have given to the bomber crews have given the impression that the bombing raids were semi-automatic and the crews had a great deal of their work automatically done for them, let it be dispelled once and for all. Radar made the accuracy of our bombing attack possible, but it in no way alleviated the hardships and hazards undertaken by every man on every raid. The aircrews of Bomber Command have had a gruelling, tough and mortally dangerous job throughout our years of war—a job second to none in any branch of any Service—they are the power and the glory of our Air Force.

R.A.F. GIFT TO DANES

AT Aarhus, in Denmark, recently, the scene of one of the most spectacular R.A.F. Mosquito "pin-point" attacks, Air Chief Marshal Sir W. Sholto Douglas, Air Commander-in-Chief British Air Forces of Occupation, presented to the Crown Prince of Denmark a cheque for 470,000 kroner (about £20,000). The presentation was made at the biggest store in Aarhus when Sir Sholto Douglas opened an R.A.F. exhibition there.

The cheque was a contribution from the R.A.F. to aid those Danes unavoidably injured in the R.A.F. raid on the Gestapo Headquarters at Aarhus, Copenhagen and Odense. It represented the proceeds of the big R.A.F. fly-past which took place in Copenhagen last month, and at which more than half the population of Copenhagen were spectators. The Crown Prince and Sir Sholto Douglas arrived at the exhibition together, and the crews of six of the Mosquitos which took part in all the three "pin-point" attacks in Denmark were also present. Typhoon squadrons of No. 83 Group flew over Aarhus at roof-top height at the same time.

The exhibition was similar to those already seen by millions in Brussels, Paris, Copenhagen, Antwerp and Nice.

In addition to hundreds of photographs of all phases of the activities of the R.A.F., there is a Link trainer which the spectators can use, a Spitfire, a cinema showing R.A.F. documentary films, and working models of all types of R.A.F. apparatus.

THE WANBOROUGH ACCIDENT

IT was not stated, at the adjourned inquest at Godalming last week, what was the nature of the secret device on which Mr. Henry V. Becker (34), Scientific Officer, Royal Aircraft Establishment, Farnborough, was engaged when he was killed on August 23rd at Wanborough, near Guildford, through the disintegration in the air of the Mosquito aircraft in which he was acting as observer. Walter George Bushell, Senior Engineer Officer of the Experimental Flying Department at Farnborough, told the coroner that he had no doubt whatever that the aircraft before the accident was thoroughly serviceable.

The accident, said witness, was caused through adverse characteristics developing in the experimental equipment. This experimental equipment was being developed to make aircraft safer, and Mr. Becker had been engaged on these tests since their beginning.

Flt. Lt. Clive L. Brooke, R.A.F., Farnborough, the injured pilot of the aircraft, said that it broke up in mid-air without apparent cause. "I was thrown out but had sufficient consciousness to pull the cord of my parachute."

Medical evidence was given that Mr. Becker's death was due to multiple fractures and injuries, and a verdict of accidental death was recorded.

AVRO VICTORY BANQUET

AN Avro Victory Banquet organised by the Superintendents' and Foremen's Joint Council was held recently at Belle Vue, Manchester. The guest of honour was Sir Roy Dobson, C.B.E., director and general manager, who paid a tribute to the energy and skill of some 300 key personnel who had made possible the organisation of the Avro bomber programme. Sir Roy outlined the achievements of the company during the war and forecast a period of intensive research and development in the peace to come. "I would like to give you all a rest," he said, "but if I did so, it would be 'goodbye' to Avro."

The dinner was followed by a programme of entertainment, and music was played during the evening by the Avro Band.

Safety Fuels

Standard Oil and Pan American Plan Refuelling in the Air

HAILED as what may be one of the most important technical advances in aviation—practical development of a high-octane safety fuel for use in aircraft engines—was announced in New York recently, with a demonstration of the new fuel's safety qualities by technicians of Standard Oil Company (New Jersey) and Pan American World Airways. The new safety fuel provides a safety factor which, aviation engineers say, will increase utilisation of commercial aircraft by making refuelling in the air practical for long-range operation.* The fuel ensures the same power as that provided by conventional 100-octane petrol, but is so resistant to accidental ignition that a lighted match can be dropped into it.

"This is an important technical advance in aviation," declared Andre Priester, chief engineer of Pan American World Airways in describing the use of the fuel in aircraft. E. V. Murphree, vice-president of the Central Technical Organisation of Standard Oil Company (New Jersey), said that, seeking to reduce to a minimum the hazards of handling petrol, petroleum research chemists have succeeded in harnessing hydrocarbons into a fuel as safe as kerosene, but with combustion power equal to the best fast-vaporising petrols. He pointed out that conventional motor or aviation petrol ignites readily and burns rapidly when spilled because of the inflammable vapours formed. The fuel used in the demonstration must be heated to more than 100 deg. Fahr. to produce enough vapours to ignite, thus eliminating the dangers of flash fire.

Illustrating its safety qualities, technicians had lighted matches dropped into their hands cupped with the fuel and doused lighted cigarettes in ash trays filled with the liquid. The practicability of the fuel was proved in recent running tests which the Wright Aeronautical Corporation conducted for Pan American at the Wright plant in Paterson, N.J., in a high-powered engine similar to those to be used by Pan American in their large post-war global Clippers. These tests indicated that on every score safety fuel delivered the same horsepower as the best high-octane petrol in use to-day. The new fuel must be fed by direct injection rather than by ordinary carburation, and it will be necessary to convert the high-power engines of post-war Clippers to fuel injection when safety fuel is put into use, unless suitable carburettors are developed. It was explained that after the fuel is injected in the cylinder it is vaporised by the heat developed during compression. The fuel mixture is fired by the conventional sparking plug.

During its development a type of Standard Oil's new fuel has been used to test fuel pipeline systems on aircraft carriers. Its safe qualities have made it ideal for actual circulation tests, while the carriers were being built or repaired, without the danger of flash fires from the sparks of a welder's torch or static electricity. Safety fuel that has remained in the carrier's petrol pipeline systems has blended safely with the conventional high-octane petrol, and there has been no danger of a contaminated mixture for the aircraft motors.

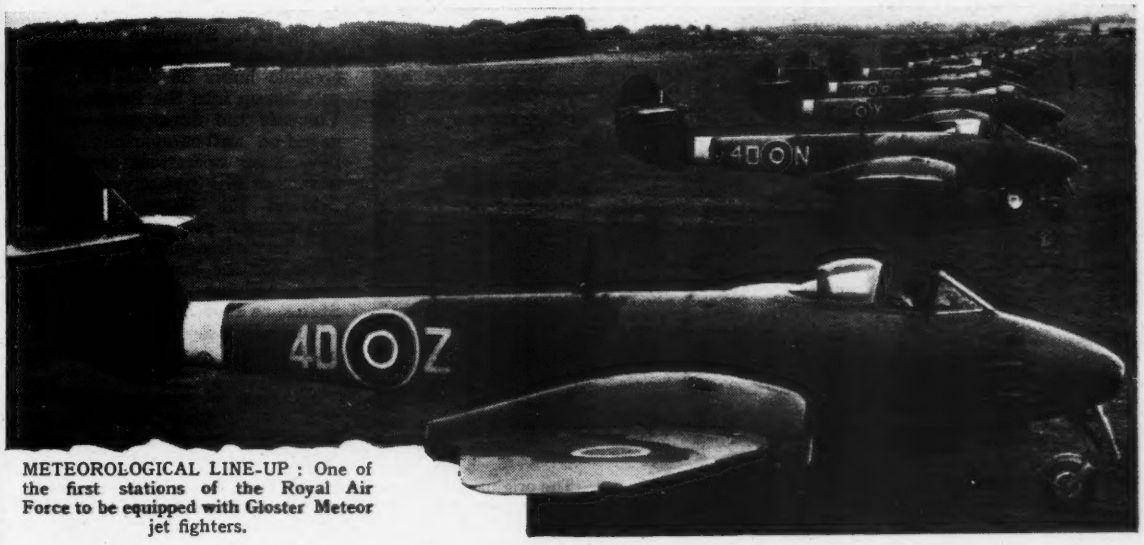
Pan American's chief engineer said that he was sure that the interest of all United States airlines and aircraft engine manufacturers would make possible the production of safety fuel in quantity at costs as reasonable as present-day high-octane gasoline. "In addition to making flights safer, the use of safety fuel contributes importantly to various aspects of airline efficiency," declared Mr. Priester. "Use of safety fuel may make practical safe refuelling in the air, increasing the efficiency of long-range operations. The mechanics by which two aircraft may be linked in the air by a refuelling hose have been developed."

Research Begun in 1932

After pointing out that the research making safety fuel possible was actually begun in Standard Oil's Baton Rouge, La., laboratories in 1932, Mr. Murphree said the fuel has been hastened in the laboratory of war by new methods that have expanded the production of the present 100-octane petrol and has now been proved practical for aircraft engine use, as shown by the tests Pan American had conducted at the Wright plant. Many of the petroleum elements that were scarce when safety fuel was in the test tube and pilot plant stage now are available and may be readily utilised for aviation after the war frees facilities for commercial production. "The principal hazard in handling petrol under certain conditions is that, in vaporising, it quickly develops an inflammable mixture which can be accidentally ignited," Mr. Murphree declared. "This hazard has been substantially eliminated in this type of safety high-octane aviation fuel. We feel it is a particularly significant contribution to post-war aviation and an important factor in the development of larger commercial aircraft. Refinements in the fuel may come with actual use in the engines to be designed for it, and I feel sure the fifteen years of research we have put into it can solve any problems that arise in making it a genuine help to commercial aviation. Since it is not in production except in limited quantities for test purposes, it is difficult to compute the cost and volume of output, but I am confident that when the petroleum industry has completed its war job and can utilise the facilities now in use in making gasoline for our fighting planes that an adequate supply from the industry can be assured for those commercial flying operations where its special characteristics can contribute to safety," concluded Mr. Murphree.

The new safety fuel, when available, will be distributed outside the United States by the Intava organisation.

*In our issue of August 23rd, we described Sir Alan Cobham's system of refuelling in the air, in which ordinary 100-octane petrol can be used with safety, due to the practice of flushing the entire fuel system with nitrogen.—Ed.



METEOROLOGICAL LINE-UP : One of the first stations of the Royal Air Force to be equipped with Gloster Meteor jet fighters.

R.N.Z.A.F. in the Pacific

Oxfords and Harvards as Operational Aircraft : Change-over to American Types for Final Stages

Kittyhawks of a New Zealand squadron operating from Guadalcanal, in the Solomon Islands.

ON September 3rd, 1939, the Territorial Squadrons of the R.N.Z.A.F. were mobilised and put on a war footing and very shortly afterwards the Auckland, Wellington and Christchurch "T" Squadrons were amalgamated to form No. 1 (G.R.) Squadron, and based at the then recently completed Whenuapai air station at Auckland. From here patrols were continually flown over the sea approaches to Auckland and other ports, in Blackburn Baffin, Vickers Vildebeeste and Vincent aircraft.

An ambitious programme under the Empire Air Training Scheme was soon under way, with two E.F.T.S. and two F.T.S. stations in full operation, at New Plymouth, Dunedin, Christchurch and Blenheim respectively, while the big R.N.Z.A.F. base at Ohakea, near Palmerston North, became, among other things, a Navigation, Bombing and Gunnery School.

Fortunately large shipments of Airspeed Oxford Trainer aircraft arrived safely from Britain, and the de Havilland factory at Wellington was soon turning out considerable numbers of D.H.82 Tiger Moth elementary trainers. Pilots, navigators and air gunners, coming forward in ever-increasing numbers, were all able to receive their full training before being sent to Britain. Wireless operators were catered for at the Electrical and Wireless School, R.N.Z.A.F. Station Wigram.

The first breath of war touched the Dominion early in 1940, when German raiders appeared in the South Pacific, and for a short time, taking advantage of the known absence of any British naval force, played havoc with shipping around the outer seas of New Zealand and Australia, keeping always just outside the range of patrolling aircraft.

The Wellington bombers acquired by the N.Z. Government before the war had perforce to remain in England, and formed the well-known No. 75 (N.Z.) Squadron of Bomber Command, otherwise the depredations of these raiders might have been greatly curtailed. However, one immediate result was the increase in operational squadrons, and Nos. 2 and 3 (G.R.) were formed for the protection of shipping in the central and southern areas, while another reconnaissance unit, later to become No. 4 G.R., was established 1,200 miles to the north in the British Crown Colony of Fiji. These squadrons flew many thousands of miles on sea patrols in Vickers Vincent aircraft, until in the middle of 1941 they were replaced by Lockheed Hudsons.

Pearl Harbour Attack

The staggering attack on Pearl Harbour and Japan's entry into the war, placed New Zealand, overnight, in an unenviable position. With a very considerable proportion of her forces overseas engaged in the European and Middle Eastern theatres, in Navy, Air Force and Army, the Dominion's capacity for self defence was strained to the uttermost.

The G.R. Squadron in Fiji was reinforced, and Hudsons flew incredible hours on long-range patrols far up into the Pacific, whilst Vincents and Singapores were engaged on anti-submarine and shipping cover operations around the islands of Fiji themselves. In New Zealand the Hudson squadrons carried out perimeter patrols on all the approaches and provided cover for the ever-increasing convoys arriving from the United States, as New Zealand became the advanced base for the projected hitting-back operations against the Japanese.

The fear of invasion, however, was still a very real one, and auxiliary operational squadrons

The original Wellingtons for the famous No. 75 (N.Z.) Squadron R.A.F. awaiting test on Vickers Armstrongs' Weybridge airfield in 1939.

were formed with Oxfords as bombers and Harvards as dive bombers, while Hawker Hinds were formed into Army Co-operation squadrons. Despite all these hazards the training of pilots was carried on without let-up, and many hundreds of aircrew sailed for England and Canada every few months.

In May, 1942, the first fighter squadrons were established, flying Kittyhawks, and based at strategic points around the coasts and at Tonga Island. With nine G.R. squadrons now in operation, New Caledonia became the next Pacific base for the R.N.Z.A.F., and as the U.S. forces gradually halted the Japanese advance, the Air Force flag and roundels appeared in the New Hebrides, further to the north.

Base for Attack

The big convoy carrying the force of U.S. marines destined for the first definite hit back at Guadalcanal sailed from Wellington, New Zealand, in July, 1942, closely escorted by cruisers and destroyers of the United States and Royal Australian Navies, and covered by Hudsons of the R.N.Z.A.F.

The arduous Solomon Islands campaign was commenced in August, 1942, and Royal New Zealand Air Force bomber reconnaissance squadrons played an active part from the time that the famous Henderson Field on Guadalcanal became operational. With the tide of war slowly starting to ebb to the north, the immediate threat to New Zealand was removed to the extent that it now became possible to send fighter squadrons to the combat zone.

R.N.Z.A.F. Kittyhawks and Warhawks, flying in conjunction with United States Navy and Marine fighter wings, created a reputation for themselves which stands second to none in the stories of fighter pilots the world over. From Guadalcanal to Rabaul—the grimly strong Japanese base in New Britain—the British Air Force roundel was to be seen continually in the skies.

By June, 1943, the Hudsons of the G.R. squadrons, which had done magnificent service on patrol, anti-submarine, convoy and reconnaissance operations throughout the Solomons and South Pacific, were replaced by the new Lockheed Ventura PV-1. Larger, faster, and more heavily armed, these aircraft were able to take a more aggressive part in the fighting, and the gradual breaking of Japanese power in these areas.

It was natural, since it was operating under the supreme American command, and working in close and complete liaison with American squadrons, that the R.N.Z.A.F. should be entirely equipped with American aircraft.

By the time the major air battle for complete mastery was raging over the Northern Solomons and New Britain, the R.N.Z.A.F. was operating from a variety of bases, and flying oft squadrons of Ventura medium bombers, Warhawk and Corsair fighters, Avenger torpedo bombers, Dauntless dive bombers, and Catalina flying boats. The forward bases were fed by Nos. 40 and 41 (Transport) Squadrons who flew Douglas Dakotas and Lockheed Lodestars on 5,000 mile round trips between New Zealand and the Islands. Behind this organisation, again, the R.N.Z.A.F. Pacific Ferry Squadron, with detached headquarters at Honolulu, flew new aircraft out from the U.S.

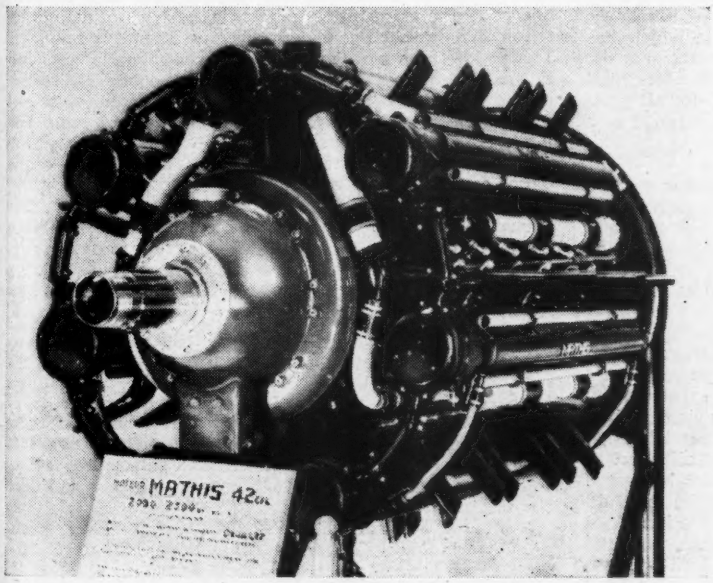
The brilliantly conceived and executed American bypassing strategy, resulting in neutralisation of strongly defended enemy bases throughout the Pacific, has defeated and outwitted the Japanese to an extent never believed possible. It is a far cry back to the days when New Zealand's operational air strength was represented by two general reconnaissance squadrons, but for nearly six years of war the R.N.Z.A.F has fulfilled a rôle worthy of the best traditions of the British Royal Air Forces.

The Mathis 42E 00

A New French Six-bank In-line Engine of 4,000-5,000 h.p.

FRENCH engine firms do not seem to believe that the days of the reciprocating piston engine are over, judging from details of a new type which have just reached us. The engine is a Mathis, with the type designation 42 E oo. It is of unusual arrangement in that it has six banks of seven cylinders each, or the impressive total of 42 cylinders. An aircraft with four of these engines would be the plug manufacturers' ideal!

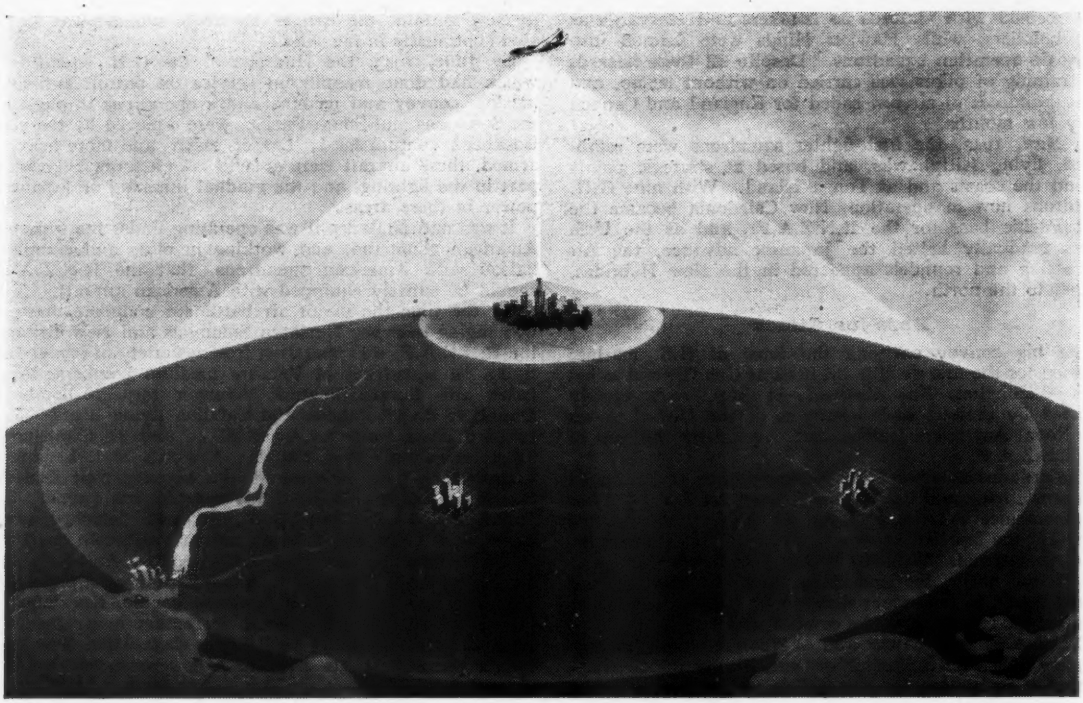
Advantages which the makers claim for this cylinder arrangement include the following: high power with good reliability, due to the low mechanical and thermal stresses; small cross-sectional area for the power developed; low weight per horse power; uniform cyclic distribution and therefore smooth torque; perfect dynamic balance.



The Mathis 42 E oo on show in Paris.

The Mathis engine is said to incorporate many patented features, and development work on various sub-assemblies was begun in 1937, to terminate now in the 42-cyl. prototype engine shown in the picture. This has a bore of 125 mm. and a stroke of 115 mm., giving a total capacity of 59.3 litres. The capacity of single cylinders is 1.41 litres. Maximum power is 2,300 b.h.p. and normal power 2,000 b.h.p. Crankshaft speed is 3,150 r.p.m. and airscrew speed 1,320 r.p.m. Cross-sectional area is 0.87 sq. m.

So promising are the preliminary test runs of this prototype regarded that already a larger engine is contemplated, generally similar to this but with a bore of 158 mm. and a stroke of 145 mm. From this larger engine a normal power of 4,000 b.h.p. is expected and a maximum power of 5,000 b.h.p. If this somewhat optimistic figure is realised, the power per unit of cross-sectional area will be 3,800 b.h.p. per sq. m.



THE KEY TO THE PROBLEM : This pictorial diagram shows the difference in the areas covered by transmission from a tower on the ground and from an aircraft flying at 30,000ft. The transmitter power required is greatly reduced.

Stratovision

Westinghouse-Martin Plans for Covering the Entire United States with Television

LAST week we published a picture of an American scheme for using aircraft as carriers of television transmitters so as to cover a very wide area. The scheme, which owes its origin to a young engineer of the Westinghouse Electric Corporation, Mr. C. E. Nobles, and which has since been developed jointly by Westinghouse and the Glenn Martin Company, is based upon the fact that television waves travel in a straight line and, for all practical purposes, stop at the horizon so that the range of a television transmitter is virtually the line-of-sight distance to the horizon.

The Westinghouse-Martin scheme proposes that a chain of aircraft should be kept flying constantly throughout the 24 hours, the origins of television and radio programmes being logically New York and Hollywood, from which the programmes would issue and be transmitted to receivers on the aircraft, which would also carry transmitters for retransmission to the next aircraft in the chain and to receiving stations on the ground within their range.

Mr. Nobles explained that the average service radius of a high-powered television station is about 50 miles and that it is difficult to cover even this radius satisfactorily, particularly in the case of the high frequencies used in high-definition colour television. At present, colour television transmitters of about five kilowatts can be built, but to cover a range of 50 miles would require some 50 kilowatts. Thus a chain of transmitters across the United States would require many relay stations, each of which would introduce a certain amount of distortion, so that by the time the picture was received at the other side of the continent the quality might well be very poor.

By raising the transmitter's aerial to a height of 30,000ft. in an aircraft, the coverage range would be increased to 211 miles, and at 50,000ft. the radius would be about 300 miles. Another interesting fact is that with high-altitude operation the transmitter power necessary to deliver a usable signal to the line-of-sight distance is sharply reduced. The 50 kW. power to 50 miles has been mentioned. One kilowatt of power will deliver from 30,000ft. the same usable signal at approximately 200 miles. Many advantages follow from this. The area covered is very large, and the low-powered transmitters can be made in sizes and weights which can readily be carried in aircraft. Power of the order of one kilowatt can be generated with valves now available, even for C.B.S. high-definition colour television frequencies. The small amount of power required to operate the transmitters can be obtained either from the main aircraft engines or from generator sets carried on board.

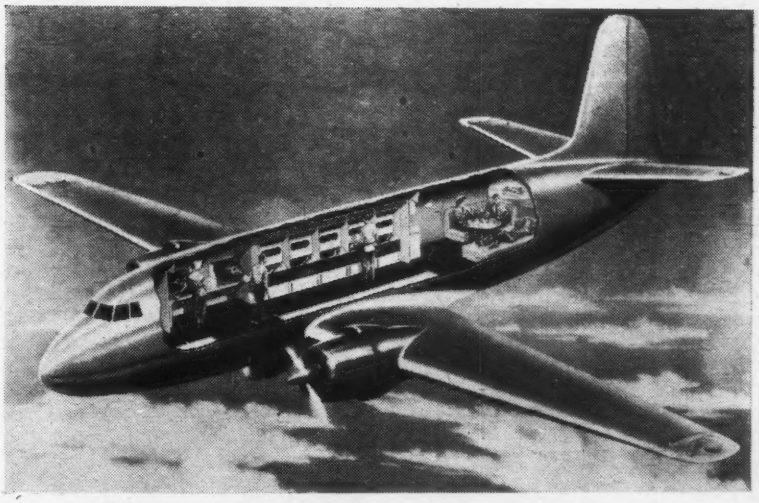
Chain Across the Continent

For broadcasting and/or television the range from aircraft to aircraft at 30,000ft. is about 400 miles, so that for relay purposes the machines would need to be flying approximately 400 miles apart. After preliminary talks with the Martin engineers it was decided that each aircraft should carry four television transmitters, five FM transmitters, monitoring equipment, and sufficient relaying equipment to carry four television programmes and five FM programmes.

And now we will quote Mr. William K. Ebel, vice-president in charge of engineering at the Glenn Martin Company. He said:

"The first and obvious question in contemplating an operation covering 24 hours a day every day in the year is—

STRATOVISION



How the Martin stratovision aircraft may look. Complete reliability is required, but only a low cruising speed.

What about the weather? So we started with a thorough study of weather and operating conditions. Our conclusion is that absolute reliability of aircraft broadcasting service is not only possible but is not too difficult to attain.

"The design of our aircraft must be such that it will operate in the highest wind velocities to be encountered at 30,000ft. These winds usually occur in the winter months and the average velocity is about 50 miles per hour over the United States. The absolute maximum velocity ever recorded was 181 miles per hour at 18,000ft. over Lansing, Michigan, in December of 1919. Winds of over 80 miles per hour at 30,000ft. occur less than 1.5 per cent. of the time at any location in the United States. Our proposed design, with its cruising speed of 140 miles per hour and high speed of over 250 miles per hour, will easily hold its own at altitude against any wind to be encountered in our continental limits. So much for our wind problem at high altitudes—What about storm areas?

"At 30,000ft. all storms are below us with the one exception of thunderheads. These clouds, known as cumulo nimbus, have been observed to reach altitudes of 40,000ft., with extreme vertical air currents of 200 miles an hour blowing straight up through their centres. However, their occurrence at altitudes of 30,000ft. is extremely rare, and the extent of such a disturbance is purely local or, even more infrequently, may be a relatively narrow band of considerable length. This is a typical cold-front configuration. Since they are clearly visible, even at night, they can be avoided with no interruption of service by flying broadcast aircraft on either side of the disturbance.

"Aircraft would take off at staggered 4-hour intervals, remaining at 30,000ft. for eight hours each. This will keep a broadcasting and a stand-by aircraft on station at all times. At each area four machines will be required, so that while two are flying the remaining two will be undergoing service maintenance of both flight and radio equipment.

Ice Prevention

"Since our aircraft must operate in all types of weather, it must be equipped with hot-air anti-icing equipment which supplies heat derived from either engine exhaust or separate heaters to the leading edges so that ice never has a chance to form. This type of ice prevention has been under development for over five years by the Army, Navy, and N.A.C.A. Several military aircraft are now operating with this equipment and it is incorporated in all new designs. Our company has made a successful installation on one of our Army bombers.

"Among the few benefits of war are the forced technological advances which make possible achievements in peace far ahead of their time. Typical of these are the development of radar, navigational aids, and blind-landing equipment in which the Westinghouse Corporation has played such a conspicuous part.

"It is no exaggeration to say that take-offs and landings will be accomplished in conditions of zero ground visibility. Indeed, the only condition in which modern aircraft cannot operate is when wind velocities on the airport introduce unwarranted landing and take-off hazards. However, with Stratovision broadcasting, the rebroadcast aircraft can take off from Chicago outside of the storm area, fly over Pittsburgh at an altitude safely above the weather and serve the area even when a hurricane may have disabled all ground equipment.

"If the country were covered with aircraft operating at all times at 30,000ft., meteorological data would be available so that we could forecast weather even more accurately than at present, and concentrate aircraft, as they are needed, near storm areas. No storm area is so large that it will keep aircraft from its outer edges from getting on stations at any time. We can safely say that with the most modern navigational, radar, anti-icing, and blind-landing equipment, and with sufficient reserve aircraft, no area would be deprived of Stratovision service because of weather.

"A question which may occur to the sceptic, as it has occurred to us—What about the reliability of the mechanical operation of aircraft? So we looked up available statistics and found a paper presented to the annual meeting of the S.A.E. at Detroit in January, 1944. This paper was entitled "Difficulties with Engines Installed in Civil Aircraft," and was delivered by Stephen H. Rolle, Chief of the Power Plant Section, Aircraft Engineering Division of the Civil Aeronautics Administration

"Briefly, this report states that in a two and one-half year period from January, 1941. to June, 1943, there were seven forced landings due to engine failure during a total of 340,000,000 miles of aircraft operation. Using an average cruising speed of 180 miles an hour, we calculated the hours of flight per forced landing and then, using mathematical laws of probability, we calculated the chances of interrupting a coast-to-coast network.

"We must now bear in mind that this interruption can only be caused by both aircraft at any one station being forced down at once. This probability in any one 24-hour day came out to be one in 30,000,000. On an average, we would have an interruption due to aircraft engine failure once every 82,000 years!

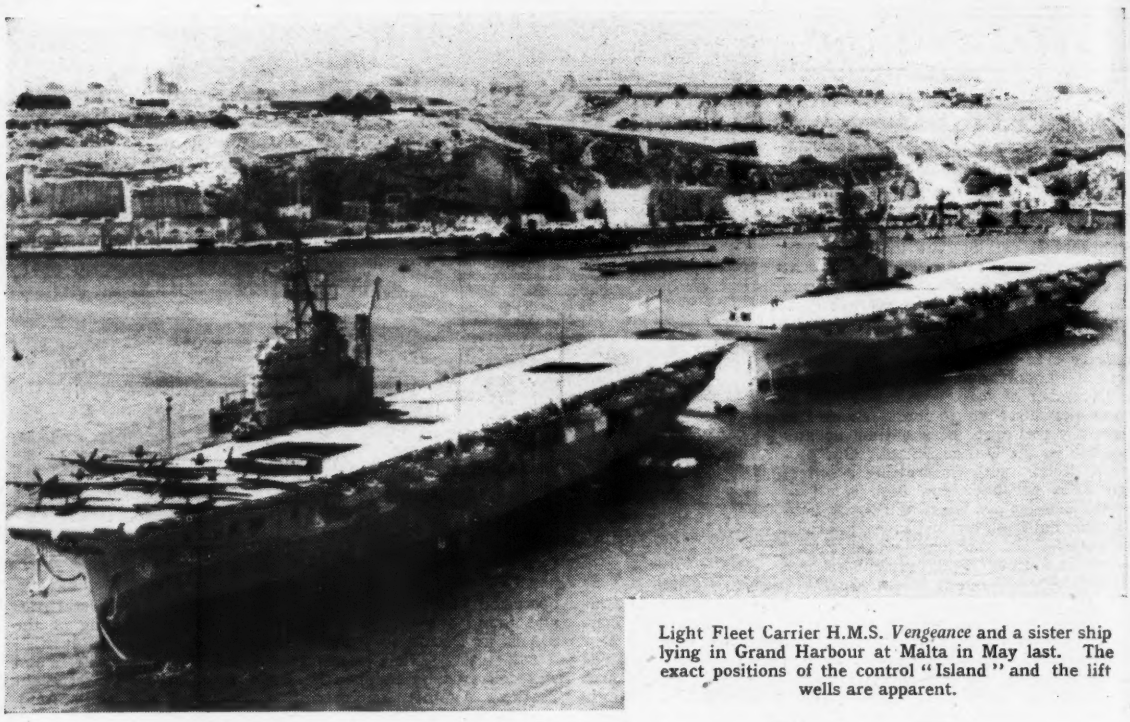
"There are other things which can force an aircraft down, such as loss of cabin supercharging pressure, but here again we will use the same technique which nullifies the effects of engine failure. We will supply 100 per cent. standby in all such items, including power-generating equipment, emergency controls, oxygen and all the other items which make aircraft reliable in war and peace.

"The aircraft, as we conceived it, will require an operational crew of three, including pilot, co-pilot, and radar operator-navigator. The broadcasting equipment will be serviced by six operators. A comfortable lounge will be provided for relaxation.

"We hesitate to say that any aircraft design is easy, but this type is unique in that for once we are not trying to go anywhere in a hurry, but instead want to go nowhere slowly. Aerodynamically the job is easy. In detail design, the provisions for cabin supercharging, heating, ventilating, and installation of aerial equipment are more difficult, but as our engineers at the plant say, they are 'just nut and bolt problems.'"

N.Z. AIRMAN RESCUES U.S. CREW

THE U.S. Air Medal recently awarded to the R.N.Z.A.F. pilot, Flying Officer A. R. Miller, of Auckland, was in recognition of a unique deed of gallantry. The Kiwi bomber pilot discovered the survivors of a U.S.A. Ventura shot down in the sea off the Solomon Islands. He dropped a life raft, and while another aircraft went to get help, he remained over the area, circling until the rescue crew arrived. Then he manœuvred skilfully to draw off the intense anti-aircraft fire from Japanese guns of all calibre so that the operation could be carried out safely. The citation ends: "By his daring, initiative and courage, Flying Officer Miller rendered valiant service at great risk to his own life in this hazardous rescue of U.S. naval personnel."



Light Fleet Carrier H.M.S. *Vengeance* and a sister ship lying in Grand Harbour at Malta in May last. The exact positions of the control "Island" and the lift wells are apparent.

Clear Upper Deck

New 14,000-ton Light Fleet Carriers : Development of Aircraft Carriers from Original Conversions

By B J. HURREN

A TRULY remarkable comparison in development between the final stages of 1918 and the end of this second major war can be traced by those with an enquiring mind. But none of the many aspects of this parallel progress have been more striking than that of the aircraft carrier.

By 1917, it will be recalled, a series of fascinating aeronautical and nautical experiments had led to the conclusion that the best way to operate aircraft at sea was by means of a flat-top. The chosen instrument was that grand old warrior, H.M.S. *Furious*, which underwent a major grafting operation for conversion from heavy cruiser to aircraft carrier.

There were many failures, and many red herrings were assiduously pursued; but the result eventually was a floating platform at sea from which to operate aircraft with land-type undercarriages.

At the end of the last war the aircraft carrier was still untried in battle. The fame of the R.N.A.S. rested on its land-based yet marine-operating squadrons, though many notable feats had been performed, such as the first successful torpedo attack from the *Ben-My-Chree* in the Eastern Mediterranean.

These new ships were anathema in the Navy. So far as the purely nautic was concerned, he listened politely to the air enthusiasts—provided the A.E.s could behave themselves in the Ward Room—or very impolitely if they assumed the habits of the plebs in the exclusive company of the officer class.

But, in the modern phrase, the Navy as a whole was far from being "sold" on the aircraft carrier, or even on aircraft at all.

The lamentable result was a succession of compromises, not only with aircraft, not only with personnel, but especially with ships. *Eagle, Furious, Courageous, Glorious, Argus, Hermes*—all until the appearance of the *Ark Royal* of 1938 were conversions, adaptations and compromises.

The *Ark Royal* turned a new leaf. It was built from stem to stern as an aircraft ship, and it was as much in advance of its earlier yet still serving sisters in arms as the modern Tudor monoplane surpasses the famous H.P.42 biplane.

Even so, under operating conditions, shortcomings became evident. The *Ark* preceded the arrival of the Deck Control Officer, for bat deck landing. It preceded the immense progress shortly to revolutionise war, under the name of radiolocation. But perhaps more significant than all other factors, the question of vulnerability to air attack had still not been determined.

It was evident to any clear-thinking officer that a direct attack by aircraft could put the carrier out of action. This was foreshadowed, and, in fact, occurred frequently, the first major casualty in this way being the *Illustrious* on the convoy to Greece, January 10th, 1940. The attack on the *Illustrious*, whose then commanding officer was Captain Boyd, now Vice-Admiral Sir Denis Boyd, Admiral (Air), was an eye-opener.

Shortly afterwards, *Formidable*, of the same class as the *Illustrious*, was likewise incapacitated for months—but not sunk—by air action off Scarpanto. Other ships of the *Illustrious* class were *Victorious* and *Indomitable*. Building under the same programme were two further large carriers, the *Implacable* and *Indefatigable*. These latter, outwardly closely similar to the earlier *Illustrious* class ships, were given a heavily armoured deck and a formidable array of defensive guns. One result was that the tonnage rose almost 50 per cent., and the two big fellows exceeded 30,000 tons.

In the meantime, the desperate need for air cover at sea was met by the makeshift Escort carriers, which were merchant vessel hulls with a "roof" for flying. They were patently vulnerable to attack, yet they succeeeded by their great mobility and element of surprise in bringing off a number of *coups* against the enemy's best defences along the Norwegian littoral, in the S. France landings (1944), at Salerno, in the Aegean, and later in the Far East, as well as superb service in the fury of the North Atlantic convoy battles.

Deck Armour

Whilst the heavily armoured large fleet carriers were building, the U.S. Navy had undertaken a simply astonishing programme of carrier construction; yet a programme which hinged on the equivalent of *Illustrious* class carriers backed up by escort carriers. In other words, the British favoured heavily armoured decks, and the Americans discarded that idea.

The most serious threat to the carriers, of both fleets, came in the closing-in attacks leading up to the assault on Japan. American and British carriers underwent the ordeal of suicide air attacks by Jap fanatics. The wisdom of the British Admiralty then became apparent; for whereas both American and British carriers were struck, and set afire, the Americans suffered major casualties and losses whilst the British carriers were *hors de combat* for no more than a few hours.

On the other hand, there was in the staff minds the *a priori* assumption that if you can protect the fleet from air attack then you would not need the costly (in man-hours and materials) process of building heavily armoured ships, although by this time the Americans had decided to build such vessels in the shape of 45,000-ton super-carriers.

To achieve air protection where the fleet wanted it and when it wanted it, the aircraft carrier stood proven as the best means of reaching this end. In a direct step the answer to more air cover was to build ships larger than the Escort carriers yet without the refinements of the large Fleet carriers.

There has thus emerged an intermediate class, called the Light Fleet Carrier, of which first details have now been released. It has been announced that the *Colossus*, *Venerable*, *Vengeance* and *Glory* are in service with the British Pacific Fleet, whilst other references have disclosed the existence of the *Leviathan*, *Powerful*, and *Ocean*.

The Light Fleets have many interesting features. They displace 14,000 tons and have a top speed of 25 knots.

Their complement of aircraft is given as 33, made up of attack, reconnaissance and fighter aircraft. This figure, which may be regarded as a mean, is interesting. It closely approaches the nominated 40 of the Large Fleet carriers, although the ships are of half the tonnage of the Big 'Uns. With aircraft parked ahead of the crash barrier, and with a strong complement of major and minor spares, it is likely that the Light Fleets could much exceed the nominal 33 aircraft.

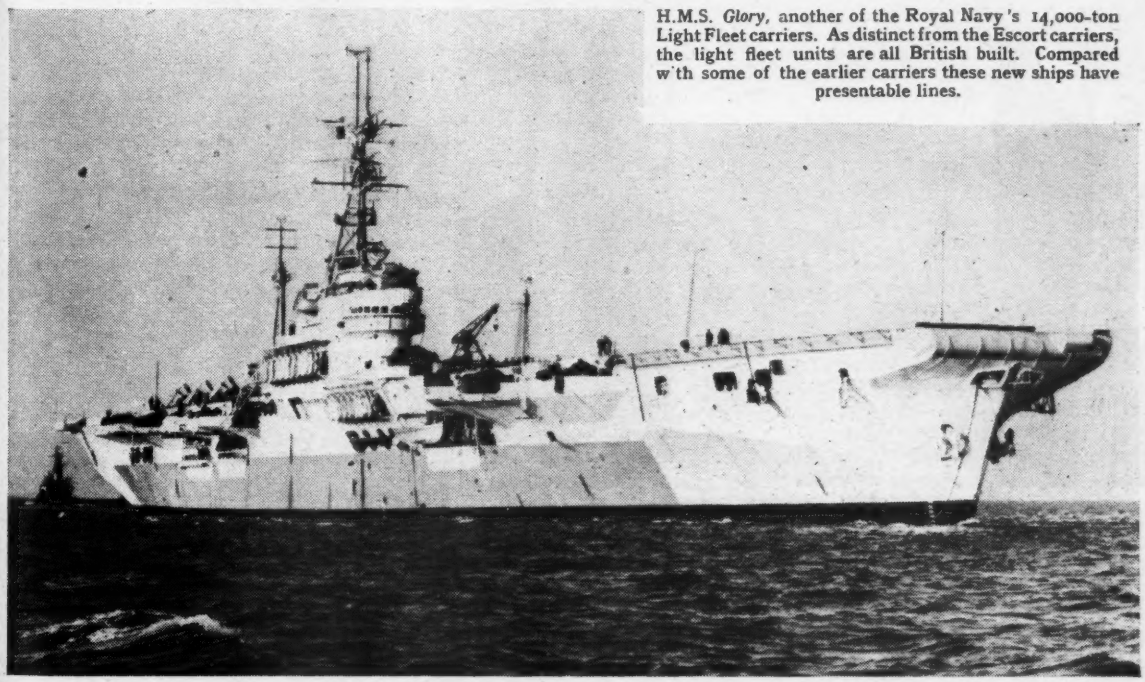
The new carriers are, in essence, merchant hulls with Service flight deck and superstructure. Space is far from lavish: the ward room might well be less than half that available in the *Illustrious* class. The deck, however, is generously free of obstructions and runs to a maximum of 695ft.

Clear Landing Area

But the most noticeable thing is the absence of guns and gunnery paraphernalia along the sides of the flight deck. Gone are the nets, the jutting barrels of guns, the range-finders and ammo store bins. In place the air pilot has a clear run; ten arrester wires across the deck give him more than enough opportunity to touch down short of the crash barrier extending athwartships by the bridge superstructure.

Internally, the technical pool system first introduced in the large carriers is an especial feature, considerably simplifying maintenance and repair work. Some of the uglier characteristics of the Escort and other new carriers have gone: one may mention, perhaps, the departure of steel mirrors from the cabins and the increase in height along the gangways so that those over 5ft. in height can now proceed without ducked—or bumped—heads.

These innovations augur well. They speak of a new outlook in the Navy, and are the outward manifestation of the hard toil in that Department of the Admiralty known by the mystic letters D.A.C.R., meaning Directorate of Airfields and Carrier Requirements. This was one of the departments introduced by Vice-Admiral Boyd when Fifth Sea Lord. It carries a number of officers with flying experience in war in aircraft carriers, many of them



H.M.S. *Glory*, another of the Royal Navy's 14,000-ton Light Fleet carriers. As distinct from the Escort carriers, the light fleet units are all British built. Compared with some of the earlier carriers these new ships have presentable lines.

CLEAR UPPER DECK

with envied decorations as a reminder of their sea service.

In short, whereas the Navy has from time immemorial been familiar with the term "Clear Lower Deck," a pipe which required everybody aft for some special assembly, it is now apparent that the upper deck has been cleared, and it may not be inappropriate to suggest that its significance is that everybody is going forward.

Now here is where the parallel with the last war arises. Post 1918, the "experts" averred the bomb would banish the ship, and a study of staff ideas reveals that many air optimists fervently believed that 250-lb. bombs would not only beat all ships but utterly destroy all German industry. Indeed, one of the most interesting things for the air historians to write about would be the air staff plan for 1939: it will be more than an eye-opener now we know the results of bombing by bombs 16, 48 and 88 times as large!

We finish this war with the same gloomy—or sunny—prognostications. The atomic explosion is here, they say. The army experts assert it will banish fleets and air forces when they get their atomic shell. The air experts predict the atomic bomb will make armies and fleets obsolete, even quite unnecessary. The navy experts foreshadow that with better aircraft carriers the atomic bomber will not even approach the Fleet, which must remain as the prime guardian of our supply routes and communications.

These things will, in time, be resolved; but in the meantime, with the dreadful lessons of the last war's aftermath to study, we must hope that our new statesmen will not be unduly swayed by the glittering mirage which atomic explosions presents in many fields of defence and attack. As one of the senior members of the Board of Admiralty is wont to say: "If in fog maintain your course—you can alter speed, but you are lost if you alter course."

DISPOSING OF THE *LUFTWAFFE'S* BOMBS

ONE of the most important jobs in the business of tidying up Germany and the European countries previously occupied by the enemy is at present providing very full-time employment for thirteen Air Disarmament Wings. German airfields and factories in Belgium, Holland, Denmark and Norway, as well as in Germany itself, where equipment for the *Luftwaffe* was produced, are the scene of operations by these special units.

Their job falls into several categories, including the disbandment of *Luftwaffe* personnel, the identification of new inventions and items of equipment, the segregation of material useful to our own Forces—such as transport aircraft—and the disposing of material which is dangerous.

In the last-named category comes the task of destroying incendiary and H.E. bombs, and recently 1,000 kilos of phosphorus and 750 kilos of H.E. were blown up together for the first time; previously the two types had been dealt with separately.

(Above) German prisoners unloading "whistling" bombs to be destroyed. Some 88,000 personnel of the *Luftwaffe*, with their own officers and N.C.O's, are still quartered on their airfields under the orders of the Air Disarmament Wings.

(Right) Phosphorus incendiary bombs and H.E. bombs are ranged in mixed groups for simultaneous disposal and—

(Top right) They produce quite an impressive pyrotechnic display when duly "touched off" from a comfortable distance.

Bombers or Rockets ?

Some Further Thoughts Prompted by the Atomic Bomb : Enormous Possibilities of Atomic Drive for Rockets

By A. V. CLEAVER

IN his August 9th article in *Flight* (" Is the Bomber Obsolescent ? "), Major Robertson discussed the morale effect of intensive bombardment which was alluded to in my original July 19th article. Suggesting that data were lacking to prove that even the prospect of utter destruction of cities would cause a belligerent nation to surrender, he concluded with the unconsciously significant words : " We have yet to see if the fate of Japan will afford any evidence."

Now indeed we have seen ; within 10 days of the dropping of two atomic bombs on Hiroshima and Nagasaki, Japan surrendered. These two atomic bombs, as one American commentator pointed out, were really bigger news than World War II itself ; the potentialities of atomic energy in war and peace raise tremendous issues for mankind, probably greater than any which have arisen at any one time before. It may be some years — even many years — before the industrial use of atomic energy revolutionises our way of life, but as the national press and radio have exhaustively pointed out, the military problems raised by atomic bombs are already with us to-day, and with a vengeance. All the sociological and moral implications of war which were briefly referred to in my original article now stare us in the face in all their stark and hideous reality — no longer as future issues to be theorised about, but as facts already experienced by the people of Japan.

In this speculative article, which follows on his original contribution in our July 19th issue, the author looks ahead and tries to evaluate the sort of powers and velocities that might be expected if we knew how to harness atomic energy for propulsive purposes. The author is chief project engineer (airscrews) of the de Havilland Aircraft Co., Ltd.

It is the purpose of this present note to enlarge on one aspect of the original " Bombers or Rockets ? " article, which contained one sentence as unconsciously prophetic in the imminence of its realisation as the one of Major Robertson's already referred to :

" If the possibility of increasing the energy of explosives by the application of atomic physics exists as a practical possibility, then this could be used, both to increase the destructive power of a given warhead weight, and also, very probably, to increase range by improving the propellant fuel of the rocket."

Regarding the first part of this statement, few will argue. The first atomic bombs were dropped from Superfortress heavy bombers (presumably a light bomber such as a Mosquito could equally have accomplished the mission), but in view of the area of destruction possible and the consequently reduced requirement for accuracy, a rocket projectile of sufficient range would have been an alternative, to be preferred on many obvious grounds. Consider the effect on London of a few V.2 rockets with atomic warheads !

No Range Limitations

Now, if atomic energy can be utilised for the propulsion of rocket projectiles, there can no longer be any question of their having a range limitation. We are left with the prospect of a future war with the belligerents throwing directed missiles at one another, with atomic warheads and atomic drive. These might possibly be countered by defensive directed missles of a similar nature, probably equipped with Radar devices enabling them to " home " on the offensive projectiles, and destroy some of them by ramming high in the upper atmosphere or beyond. Aircraft would still find a relatively limited use as troop carriers for occupying forces, and for reconnaissance, and for those missions in which it was desired to inflict damage rather than complete destruction on the enemy.

General Arnold and others, in recent weeks, have foreseen the possibility of such a war ; it remains only to observe that it would preclude the survival of much of the civilisation which allowed it to begin.

Atomic Drive for Rockets

The performance of a rocket projectile is fundamentally related to the exhaust velocity of its jet. Where this $= v$, and L is the energy content (calorific value) of the propellant fuel used, then : $v \propto \sqrt{L}$.

Published statements on the atomic bomb have quoted its weight as about 400lb. and its effectiveness as equivalent to 20,000 tons of bombs with normal explosive warheads ; this would give an energy content ratio of $\frac{20,000 \times 2,240}{400}$, implying an exhaust velocity ratio equal to the square root of this number, *i.e.*, 335. Actually, the increase in possible exhaust velocity would be larger than this, because the atomic bomb contained only 8 lb. of Uranium 235 " explosive," whereas 20,000 tons of normal bombs would contain about 16,000 tons of explosive. These latter figures would suggest a possible exhaust velocity ratio of :

$$\sqrt{\frac{16,000 \times 2,240}{8}} = 2,120$$

Assuming even the lower figure (since all these figures are so hypothetical that their relative accuracy is unimportant — it is desired only to indicate an overwhelming general trend), some startling conclusions can be drawn.

If the starting mass of a rocket is denoted by M_o, and it consumes a mass of fuel $= M_o - M$ in accelerating to a velocity $= v_o$ at the end of its powered flight, then :—

$$\frac{M_o}{M} = e^{v_o/v}$$, where v is the exhaust velocity as before. This simple expression neglects performance losses due to air drag and gravitational attraction during the climb, but will serve to illustrate the point at present in question. The rocket, after its motors cease thrusting, will behave just like, for example, an artillery projectile, *i.e.*, its total range is a function of the velocity v_o at the end of its powered flight.

If normal bomb warhead explosives were used as propellant fuels in a chemical rocket motor, they would give an exhaust velocity of about 7,000 ft./sec. Of course, they are not so used, partly because of the difficulty of controlling their action (rate of burning), but also because of their lower energy content as compared with fuels such as alcohol or petrol burned with liquid oxygen ; an alcohol-oxygen mixture such as was used in V.2 should give an actual exhaust velocity of about 8,000 ft./sec. (with 100 per cent. motor thermal efficiency, the value would be 13,700 ft./sec.).

In V.2, with its range of about 200 miles, the alcohol plus oxygen weight consumed was approximately 8 tons, and the starting weight 12 tons.

Thus, the mass ratio $= \frac{M_o}{M} = \frac{12}{12 - 8}$

$$= 3.0 = e^{\frac{v_o \text{ (ft./sec.)}}{8,000}}$$

$$\therefore v_o = 6,000 \text{ m.p.h.}$$

(This is the velocity at end of powered vertical flight which

BOMBERS OR ROCKETS?

V.2 would have if gravity and air drag were absent.)

Using an atomic drive, we have suggested that the exhaust velocity might = 335 × 7,000 ft./sec. at least, since an atomic fuel should give not less than 335 times the exhaust velocity of an explosive fuel.

= 2,350,000 ft./sec. at least.

In other words, the mass ratio for the same range and payload (*i.e.*, for the same value of v_o) as V.2 would be given by

$$\frac{M_o}{M} = e^{\frac{8{,}800 \text{ ft./sec.}}{2{,}350{,}000 \text{ ft./sec.}}}$$

$$= 1.004 \text{ at most, instead of } 3.0 !$$

There would no longer be any argument about the "economy" of rocket projectiles—the fuel load required would be negligible (36 lb. instead of 8 tons !).

To look at the matter in another, and even more striking, way, we can work out what final velocity our hypothetical rocket with atomic drive would have if we gave it the same mass ratio as V.2.

$$3.0 = e^{\frac{v_o \text{ (ft./sec.)}}{2{,}350{,}000}}$$

$$\therefore v_o = 1{,}760{,}000 \text{ m.p.h.}$$

This would be far more than sufficient, even after allowing for gravity and air drag, to fling the projectile to infinity; 1,760,000 m.p.h. is vastly in excess of the escape velocity from this planet. Intermediate mass ratios between 3.0 and 1.004 would therefore give an atomic rocket any desired range. Any point on the earth's surface could be reached from any other point.

Readers will no doubt be saying, "All that is all very well, but what justification is there for the assumption that atomic energy could be used for reaction propulsion?" The writer can make only the following answers, which he finds personally satisfying and can only hope others will, too.

Sceptical Discoverers

1. Every time a new scientific discovery is made, it is curious that those who make it are often the most sceptical of its practical application to particular problems. Hertz first detected radio waves, but scoffed at the suggestion that they might ever be used for tele-communication. Only a few years ago, some of the very men who have now helped to produce the atomic bomb were deprecating suggestions that atomic energy would ever be released on anything but a laboratory scale. (It is well appreciated this is not a scientific argument, but it—and point (2) below similarly—constitutes, I believe, a significant consideration.

2. All those who have ever considered the use of rocket propulsion for any duty have realised that they are dealing fundamentally with an energy problem, of obtaining sufficient stores of energy to accomplish the work required in a practical manner. The release of atomic energy unlocks for us the door to stores of power immeasurably greater than any we have known before. It is surely very improbable that these two facts will never be associated, that the second will not provide the solution to the first.

3. Perhaps an atomic drive might be provided by the reaction from radiation pressure generated by the atomic explosion. Perhaps the reaction might be provided by a stream of minute sub-atomic particles travelling at immense velocities, giving a jet of very small mass and huge speed. This would have very low propulsive efficiency, except at incredible flight velocities, but that would not matter where such large energy stocks were available. In either case, the "jet" so generated would be even more deadly than the gas blast from a V.2; presumably the problem would reduce to making it uni-directional. Perhaps this might be achieved by some technique of using electric or magnetic fields surrounding the propulsive "nozzle"; perhaps some of the energy of the atomic explosion could be used to provide these fields—rather as some of the gas energy is used in the turbine of a Whittle unit to drive the compressor, which is a necessary component of such present jet engines.

Perhaps the atomic explosion could be used to heat some working fluid which would itself provide the propulsive jet.

Perhaps—very probably !—none of these things, but something else.

Non-Military Possibilities of Rockets

The uses of rocket projectiles for ultra-high speed terrestial transportation, for providing stations for many purposes high above the earth's atmospheric limits, and for interplanetary travel, have been considered by many technicians. With atomic drive, all these Wellsian dreams would become practical of achievement. Whereas, so far, they have been bare technical possibilities, attainable only on a marginal basis of practicability due to the huge fuel loads required, they would then become what might be termed (for want of better words) commercial propositions. Anyone who feels disinclined to take seriously mention of such developments would do well to consider the advent of radar, jet propulsion, V.2 rockets, and finally, the atomic bomb, during the last short six years, to say nothing of the development of aviation itself since the Wrights first flew in 1903.

The fascinating possibility last mentioned, namely, space flight, would be an achievement of outstanding moment, truly worthwhile in the real sense of that expression relative to man's development, and with the greatest practical and philosophical impact on his outlook. Its realisation depends essentially on imparting to a projectile with reasonable acceleration, a velocity termed the "velocity of liberation" or "escape velocity."

Once a ship was moving with this speed (= 25,000 m.p.h.), it would never fall back to earth even after the motors ceased thrusting, but would travel outwards into space with ever diminishing, but always positive, velocity, free to be manœuvred into the gravitational field of any other planetary body its crew desired to visit. After allowing for the effects of gravity, air drag while traversing the atmosphere, fuel reserve for manœuvring, landing and return journey, one might very conservatively guess that an equivalent "required velocity at end of powered flight" might be as much as 100,000 m.p.h. instead of the bare 25,000 m.p.h. escape velocity. In other words, the fuel needed to do the actual job required after allowing for these factors, could be assumed to be equivalent to that needed for the alternative task of imparting a v_o of 100,000 m.p.h., instead of 25,000 m.p.h., under conditions where these other factors were absent. (It could be shown that this is a very severe assumption). Reverting to the simple formula used earlier, we would then have:

$$\frac{M_o}{M} = e^{\frac{147{,}000}{2{,}350{,}000}} \text{ for an atomic-driven space ship}$$

$$= 1.065.$$

i.e., the fuel weight would be only 6½ per cent. as much as the final landing weight of the ship. Even the most optimistic of estimators have suggested that a fuel weight of very many *times* the final landing weight would have been necessary with the present types of chemical-fuelled rocket motors.

As a concluding note, it is relevant to this article to quote a remark made some years ago by a friend of the writer who is now in the R.A.F. and who shares an interest in this absorbing subject. This man (one Fl./Lt. A. C. Clarke) then observed, "The release of atomic energy will make interplanetary travel not only possible but imperative." At the time, the wit of this epigrammatic remark seemed more to the point than its practical importance; it appears now that this situation is possibly reversed.

SURPLUS R.C.A.F. EQUIPMENT

AIRMEN'S helmets, gauntlets, goggles and men's leather belts are included in a list of goods declared surplus by the R.C.A.F. and will be nationally distributed through wholesalers by the War Assets Corporation. There are 30,000 leather helmets, and 15,000 pairs of gauntlets. About 20,000 belts are to be released. Only new belts are to be sold in Canada, the other going with clothing for relief in Europe.

Reports and Memoranda*

R. and M. 1930: The Conditions Behind the Trailing Edge of the Supersonic Aerofoil. By M. L. Lighthill, B.A., of the Aerodynamics Division, N.P.L. 8 pp., 6 diag., January 31st, 1944. 2s. net.

In "Two-Dimensional Supersonic Aerofoil Theory," R. & M. 1929, by the same author discussion in detail of the conditions behind the trailing edge of a supersonic aerofoil was omitted. The omission was made because the conditions do not affect the forces on the aerofoil, and because they would suffer more than any other characteristics of the flow from the effects of viscosity.

Some importance is attached to the conditions behind the trailing edge of a wing as the tailplane is situated there, and the present paper advances a non-viscous theory. It also considers the shape of the shock-waves far behind the aerofoil and finds them to be approximately parabolic.

R. and M. 1931: Some Experimental Determinations of the Apparent Additional Mass Effect for an Aerofoil and for Flat Plates. By C. Scruton, B.Sc., of the Aerodynamics Division, N.P.L. 8 pp., 4 diag., October 27th 1941. 2s. net.

Values of the true structural moments of inertia of model and full-scale wings and control surfaces are required frequently for flutter investigations. An accurate calculation of these is not often practicable, but they may be determined from oscillation experiments in air if the effect of the air on the motion is known.

The effect on the motion of a body due to the energy imparted to the surrounding air is conveniently regarded as an addition to the inertias of the body. It is variously described as "the apparent additional mass effect" and "the virtual mass effect."

Experiments to determine these quantities have been confined almost exclusively to tests on flat plates whilst theoretical considerations have led to solutions in only a few cases. W. P. Jones, in R. and M. 1953, has obtained theoretical values for thin plates of finite span moving in a perfect fluid. The effect of frequency of oscillation on the quantities, due to viscosity, is commonly neglected in both experimental and theoretical work, but where it has been considered, e.g., in the case of the sphere, its effect is not large except for very slow oscillations and rapidly decreases with increase in frequency.

Part 1 of this report describes briefly an attempt to measure the additional inertia corresponding to pitching oscillations of an aerofoil at various frequencies. The accuracy obtained by the method was not satisfactory.

Part 2 demonstrates, with the use of rectangular flat plates, a very simple method for the experimental determination of the additional mass effect for flat bodies. The method requires no elaborate apparatus, gives good accuracy, and is suitable for determinations on aerofoils and control surfaces.

R. and M. 1932. Force and Pressure Measurements on V-Shapes on Impact with Water Compared with Theory and Seaplane Alighting Results. My E. T. Jones, M. Eng., and R. W. Blundell, M.Sc., Communicated by the Director of Scientific Research, Ministry of Aircraft Production. 23 pp., 18 diag., January, 1938. 4s. net.

Measurements of pressure and total impact force on a V-shape and on seaplane hulls have been made, and it was desirable that further tests be made and the complete results compared with the impact theory.

The pressure measurements described in an unpublished report have been extended to include the effect of translational velocity and further measurements of impact force have been made.

The experimental results are compared with full-scale work and the results of Wagner's theory of impact forces are compared with the experimental results.

The conclusions reached are that:—

1. The measured peak pressure at any point on a V-shape with straight sides is related to the impact conditions by a simple empirical law.

2. This law has been applied to alighting impact conditions of the Scutham,pton and Perth seaplanes and to the vertical impact tests on the Singapore IIc, and very good agreement with the measured pressures is shown in all cases. Since the planing bottoms of two of these seaplanes are curved in transverse section there is evidence that the law applies to V-shapes with curves as well as straight sides.

3. The peak pressure at any point on a V-shape calculated by Wagner's theory of impacts exceeds the measured peak pressure, though the mean pressure over the section immersed at any time agrees well with the measured mean. Theory shows that the peak pressure at, or very close to, the boundary of the pressure surface so that the discrepancy between calculated and measured pressures is partly due to the comparatively large diameter f the diaphragm used in the measurements, over which the average pressure only is registered.

4. The peak force of impact over a V-shape agrees well with that calculated by Wagner's theory.

5. Theory and experiment agree in showing that a hull with a slightly less transverse curvature than that of the Singapore IIc would have a constant peak pressure between keel and chine.

6. Theory and experiment agree in showing that the maximum force of impact occurs at a constant immersion, irrespective of the striking velocity. They also agree in showing that for this immersion the chines of a modern boat seaplane are well clear of the water, hence a reduction of beam on modern practice would not occasion an increase in normal force on alighting.

* *Summaries of Recent Issues Printed and Published by and obtainable from H.M. Stationery Office.*

BOOK REVIEWS

Bridging the Atlantic. Compiled by N. C. Baldwin. Francis J. Field, Ltd. 10s. 6d.

THIS is a chronological history of Atlantic flights "proposed, attempted and successful," together with a priced air mail catalogue of all countries. As such it will make a strong appeal to philatelists and air mail cachet collectors as a handy reference. The preparation of such a book during the hampering conditions of a world war when many important libraries in Britain and abroad were ungetatable must have been a difficult task, but it was done by recourse to the thousands of English and foreign books and Press cuttings in the publishers' own records. It spans the years 1873 (when an unsuccessful attempt was made to fly (or rather "drift") from New York to Europe in a balloon) to November 7th, 1944, when an air letter service was begun between Jamaica and the U.K. Obviously, no attempt could be made to chronicle all events since 1939, but otherwise it is a wonderfully comprehensive historical record.

Soaring Flight. By Terence Horsley. Eyre and Spottiswoode. 16s.

THOSE who have graduated from the glider to the sailplane and have achieved even only one soaring flight will know all about that feeling of slipping "the bonds which bind the soul to the earth" (to quote Mr. Horsley), but they will nevertheless be pleasantly thrilled by his account of finding a thermal at Sutton Bank, getting up to 4,500ft. on a day when all previous attempts to find any lift had failed, and finally landing at Welburn airfield near Kirby Moorside. But this is only by way of introduction to a 300-page book which covers practically every aspect of this fascinating sport and is nicely illustrated by photographs and diagrams. The author, a Fleet Air Arm pilot with "about a thousand hours in the air," brings two things to this book which lift it clean above the normal level of its kind—a genuine passion for his subject and a decided gift as a writer. There are endless temptations to quote from the chapter headed, quite simply, "Airborne," but space forbids the luxury.

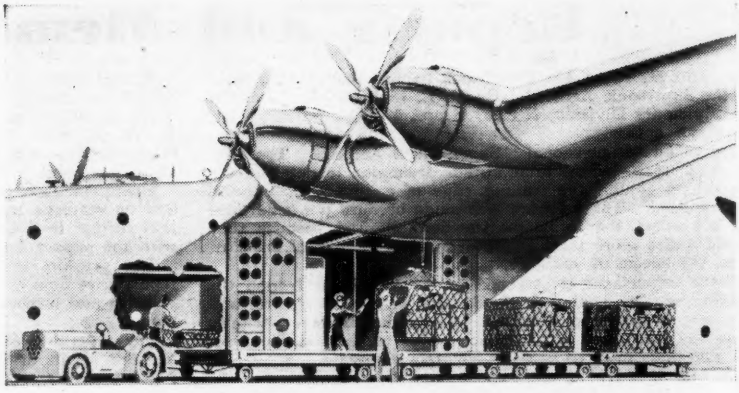
How to Organise a Club for Aeromodellers. Association of British Aeromodellers. 1s.

THE widespread and still growing interest in the designing, building and flying of model aircraft, a pastime which is looked upon with favour by the aircraft industry in Britain and is even given Government recognition in Canada, the U.S.A. and Soviet Russia among other countries, has resulted in the springing up of clubs all over the country. This shilling booklet is a useful guide to those who want to form a club in their own district but, lacking experience of such things, could use a little expert advice. Much of the advice given could be applied to the formation of any kind of club, but the special needs of aeromodellers are additionally met.

CIVIL AVIATION

Ease of Handling

Planned Freight Loading : Efficient Equipment



PACKING THE MARS : Freight is loaded in special nets on wooden flats duplicating the aircraft freight deck. A hoist swings nets into the aircraft leaving flats behind.

A STREAMLINED cargo-handling system devised for speeding vitally needed supplies to the Pacific war front via the 72½-ton Mars transports and developed by the U.S. Naval Air Transport Service, may provide the answer to a problem of practical concern for all future operators of large flying boats on global routes.

Extremely simple and demanding no costly equipment, the plan permits maximum utilisation of Mars transport cargo space, while reducing to a minimum the time, paper work and man-power needed for loading and unloading. It assures centralised location control over every item along the whole route from the U.S. to the Far Pacific.

Load planning is the keynote, determining the handling of cargo from the moment of arrival at the warehouse to the time it is actually in the aircraft and until it reaches its final destination. Except for specially tagged fragile items, or bulky articles like jeeps and aircraft engines, individual handling of pieces has been eliminated. Regular cargo is segregated by destination, priority and bulk, and is stationed on the aircraft with due regard for convenient access as well as critical balance factors.

Checking and segregation of cargo is performed in a warehouse adjacent to the flying-boat dock. Special non-stretch nets, with eyelets at the four corners, are spread on specially constructed, oblong wooden flats which constitute a breakdown replica of the aircraft cargo deck. Cargo is loaded to a uniform height on the flats and tightly netted by means of a rope run through the eyelets, so that no movement of pieces occurs. Each flat has a number which is used for cargo control purposes.

When filled, every net is tagged by priority, destination and a number corresponding to the flat. It has been estimated that a mere two hours is needed to check 30,000lb. of cargo, containing several thousand items, from trucks on to flats.

All essential information, including flat-number, priority, destinations, weight and location in the aircraft, is graphically listed on several standardised, highly simplified forms. For practical purposes, the flying ship has been loaded on paper even before it arrives in port.

Mechanical shop mules and trailers, rather than trucks, are used to haul the netted cargo to the boat. A cargo-hoist built into the vast wing of the JRM-Mars picks up the nets and swings them into the main cargo compartment, leaving the flats behind.. Three men, one working outside and two inside the aircraft, can easily load the entire flying boat.

In the fore and aft compartments, where the cargo-hoist does not extend, low-wheeled "skates," which are base equipment furnished with the aircraft, can be used for moving cargo to the desired location. Removing cargo from the "skates" is facilitated by three evenly spaced rings embedded in the ceilings, through which a block-and-tackle may be placed. Tie-down fittings and specially designed non-slip lashing equipment hold the nets in place during flight.

Cargo destined for far-away ports is placed fore or aft in the aircraft, and that likely to be unloaded first is placed near the centre. Main weight is at all time concentrated amidships.

As soon as the flying boat arrives at an intermediate station, the Transport Officer there can tell by merely glancing at the standardised forms and manifests what the total off weight and through weight will be, as well as the compartment weight reduction. He is able to calculate rapidly the loads allowable to the next station and the aircraft's balance when intermediate loads have been removed.

Thus delays are minimised in placement of local loads, and unloading crews at those stations can promptly locate the freight consigned to them. Through freight of high priority, meanwhile, is put through on one line to its final destination without being unduly interfered with in transit.

I.C.A.N. Conference Closed

THE 28th session of the International Commission for Air Navigation (I.C.A.N.) held in London from August 21st to 25th approved at its final meeting a series of recommendations revising the draft air rules proposed at the Chicago Conference.

The States taking part in the International Civil Aviation Conference (Chicago, November-December, 1944) were invited to present any suitable recommendations for additions, deletions or amendments with regard to the draft Technical Annexes in the Final Act of the conference.

After a detailed examination of the text of these Annexes, the I.C.A.N. decided to transmit to the P.I.C.A.O. the result of its work on the Annexes.

As these draft Annexes have not yet been adopted in their final form by the Chicago Conference, the Commission also proceeded to a revision of Annexes A to G to the Paris Convention. These Annexes deal with Classification of Aircraft (A), Certificates of Airworthiness (B), Logbooks (C), Lights and Signals, Rules for Air Traffic (D), Crew Licences (E), Maps and Ground Signs (F) and Meteorological Information (G). Additional regulations adopted by the I.C.A.N. which together form the only system of regulations whose application is at present compulsory came also under revision.

The Commission accordingly made a few amendments in Annexes A, C and F to the Paris Convention and adopted for Annexes D and G to the Convention new texts which followed as closely as possible the corresponding provisions of the technical Annexes of Chicago, besides taking into account the latest technical developments. With a similar intention, the I.C.A.N. adopted a new text for the regulations for the International Radioelectric Service of Aircraft and for the instructions concerning the International Aeronautical Telecommunication Service.

With regard to Annex E of the Paris Convention, the Commission decided that the new text of this Annex will not in future have the same obligatory character as the present text but that it will be considered by the States as a very earnest recommendation. It therefore thought fit to suppress all the provisions of Annex E and to substitute it by a text, in the form of "Regulations for the Operating Crew of Aircraft," which the contracting States are

urged to apply as rapidly and as fully as possible within their territory.

Finally, the I.C.A.N., considering it necessary that all States should adopt a uniform system of search, rescue and investigation with regard to accidents to aircraft, decided to recommend the adoption of instructions prepared by it for that purpose, combining with them certain corresponding provisions of one of the Chicago Annexes. To facilitate the practical application of these recommendations the Commission undertook the study of the apportionment of the costs of search, rescue and investigation in the case of accidents to aircraft, and of guiding principles to assist States in establishing regional organisations for searching for aircraft believed lost and for rescuing those on board.

Mr. Ivor Thomas, Parliamentary Secretary to the Ministry of Civil Aviation, deputising for Lord Winster who was on his way to the U.S., closed the session saying that the Conference had accomplished the prodigious task of revising the eight Technical Annexes of the International Air Convention and of the relevant regulations of the I.C.A.N. and harmonised them to the greatest possible extent with the corresponding Technical Annexes adopted at the Chicago Civil Aviation Conference. In this way, they had assisted member States to give speedy effect to the resolution passed at Chicago recommending States of the world to embody the internationally acceptable practices in their national regulations.

Sir William Hildred, C.B., O.B.E., Director-General of Civil Aviation and United Kingdom delegate to the Commission, who presided over the session, said that I.C.A.N.'s work will facilitate the absorption of 25 years of practical experience into the wider body set up under the Chicago Convention.

The 29th meeting will be held next June in Madrid or Eire.

CIVIL AVIATION NEWS

ON DUTY

SQN. LDR. L. F. PAYNE on being released from the R.A.F. is back at his post as Manager of Southampton Airport.

CHINESE PLANS

PREPARATIONS are being made to open up three new air lines in China next month. According to an official of the China National Aviation Corporation the routes will be from Chungking to Shanghai, by way of Hankow and Nanking, Chungking to Siam and Peiping, and Chungking to Canton.

P.I.C.A.O.

THE Counil of the Provisional International Civil Aviation Organisation, formed last June for advisory and technical functions in international civil aviation until a permanent organisation is set up, will meet in a new session in Montreal on October 15th.

NEW ADDRESS

BRITISH LATIN AMERICAN AIR LINES, LTD., have moved their offices to 19, Grafton Street, W.1. Telephone is Regent 4141, and telegraphic address "Airlines Piccy London."

FLYING START

LORD WINSTER, the Minister of Civil Aviation, who was on a short visit to Canada and U.S., stated in Montreal that civil aviation in the future must be brought within reach of sections of the population which could not now afford the benefit of high speed at high prices.

"It is no good having India 16 hours from Britain by air if it is too expensive for most people to fly there," he said.

On his rapid tour of inspection of air bases Lord Winster was accompanied by Lord Knollys, chairman of the B.O.A.C. They arrived at Prestwick after covering some 7,500 miles in five days, during which they visited the U.S. and Canada.

FOYNES-PARIS

TRANSCONTINENTAL and Western Air plan to establish a service between Foynes (Shannon Airport) and Paris in the near future, according to Mr. J. E. Slater, of American Export Airlines, in an interview in Dublin.

He added that as far as he could see the Shannon Airport would be the focal point for all three of the American trans-atlantic services—Pan American, American Export Airlines and Transcontinental and Western Air—with feeder services radiating from that point.

Mr. Slater also indicated that feeder services will be established by Aer Lingus (Irish Airways) as soon as the necessary aircraft are available.

INNER CIRCLE PLANES

TWOPENCE HALF-PENNY a mile passenger fares are envisaged in a scheme prepared by Air Dispatch, Ltd., for the restarting of Britain's internal services.

The company has completed plans for operating an Inner Circle air service to serve London's Green Belt—picking up passengers and freight at Croydon, Heath Row, Gatwick, Redhill, Hatfield and other staging posts within a fifty-mile radius of the Metropolis.

The plan also provides for services to Paris, Brussels and Le Touquet.

The fare of 2½d. per mile will be standardised on all routes operated by the company, so that a return ticket to Paris will cost just over £4.

Passengers will be carried in 34-seater Bristol "Wayfarers"—a machine which has been specially designed for cheap air travel.

A fleet of these air liners has been ordered from the Bristol Aeroplane Company, and delivery is subject to Government approval of the scheme.

The Hon. Mrs. Victor Bruce, Managing Director of Air Dispatch, Ltd., thinks that there is no reason why her company's plan should not be incorporated in the Government's nationalisation programme and form the basis of cheap travel over short routes.

If the Government's plans are not yet ready, Air Dispatch would be prepared to go ahead and operate under Government supervision in the meantime.

VIA TOKYO

A RECOMMENDATION that two U.S. air lines be permitted to fly to Tokyo as an intermediate point on routes across the Pacific has been made by examiners of the U.S. Civil Aeronautics Board.

Pan-American Airways, it is recommended, shall be allowed to extend its central Pacific route from Midway Island via Tokyo, Shanghai, Hong Kong and Bangkok to Calcutta, and from Manila via Singapore to Batavia (Java).

Another company, North-West Air Lines, according to the recommendation, is to be allowed to fly from New York and Chicago via Edmonton (Alberta), Anchorage (Alaska), Paramushiro in the Kurile Islands, Tokyo, Shanghai and Hong Kong to Manila.

THE NEED FOR POLICY

URGING the Government to announce its civil aviation policy, Group Capt. McIntyre, managing director of Scottish Aviation, at the Ayr Rotary Club meeting, said that while we were waiting, the rest of the world was getting on with the job. He quoted the instance of Eire, which "has gained overnight, and almost without effort, all of the advantages which we have worked so hard to bring to the British mainland and to Prestwick. Throughout the war Allied military air services on the North Atlantic have been based on Prestwick. But the three United States airline companies who have been authorised to operate the Atlantic services between the enormous populations of North America and Europe find themselves bound to use the Irish Free State as their Atlantic stepping stone because of the fact that Britain does not agree with the American conception of air freedom, and has not negotiated a commercial air agreement with the United States, whereas Mr. De Valera and his Government, seeing a golden opportunity to restore and enrich the economy of Eire, did so as long ago as February.

"Those American airline companies who have become accustomed to the use of Prestwick as the main terminal on the Western approach to Europe," Group Capt. McIntyre concluded, "find themselves bound to transfer to the Shannon. In fact, the Irish Agreement includes a stipulation that those airlines will make their first stop in Europe at the Shannon, and will make a further stop at the Shannon when returning from Europe to America."

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

CENTRIFUGAL FORCE

A Stressman's Brief Solution

WITH reference to the query on centrifugal force in the August 16th issue of *Flight*, the tormented South-East Asian Soul has illustrated, after a lot of hard work, the well-known fact that for small angles tan α is approximately equal to α, when α is measured in radians. His correction factor K merely transfers tan α to $\alpha°$. Alternatively the expression he requires for centrifugal force may be easily derived as follows :—

$$V = r\alpha(\alpha \text{ in radians})$$

$$\therefore \frac{V}{r} = \alpha$$

$$\text{Centrifugal force} = \frac{V^2}{r}$$

$$= V\alpha$$

Or if our friend does not like working with the mysterious radians and prefers the mystic π

$$\text{Centrifugal force} \frac{\pi V\alpha}{180}$$

where α is measured in degrees.

R SWINGLER, B.Sc.
Chief Stressman (Propellers),
De Havilland Aircraft Co., Ltd.

RADIO FOR LIGHT AIRCRAFT

Question of Cost and Space

NOT infrequently, nowadays, the subject of fitting radio equipment in light aircraft comes under discussion.

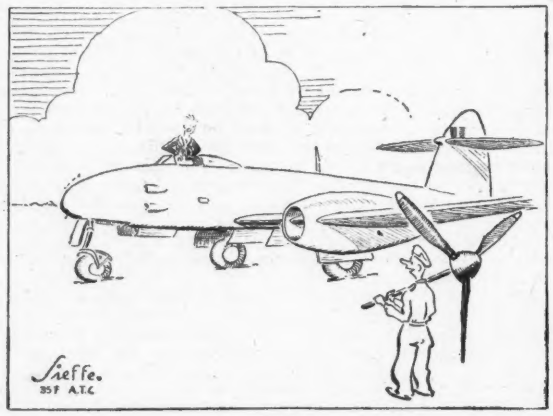
Most people seem to be of the opinion that this cannot be done without involving much expense and also loss of valuable space, and it is true that to fit radio equipment, say, similar to that carried by Taylorcraft "Austers" would involve considerable expense and take up a disproportionate amount of space.

The main consideration, of course, is whether the radio facilities are to be used for navigation or solely as a means of added control at large airports. In the latter case, which, I think, is usually being considered, it would seem that to provide these facilities would not involve much expense, and space lost would be negligible.

The type of equipment I have in mind would be similar to the small portable R/T sets used by our own and Allied services. These sets weigh about 5 lb., are completely self-contained, and have a range of sometimes up to ten miles. They are very easy to operate, and if produced in any numbers would certainly be inexpensive.

Whatever regulations are formulated in relation to radio and private flying, this equipment would seem the only type which could be fitted, and by its low cost, etc., would not ground many would-be private owners.

DOUGLAS DEANS.



Well ?

R.O.C.

In Which A=B

IN *Flight*, August 23rd, you publish a letter from "Two very browned-off ex-P.B.O.s." These two, like many others, feel that they have been tossed aside and forgotten and that, in direct contrast, the "A" man is living on a bed of roses and visits to Farnborough.

They note that—"it would seem . . . R.O.C. Rally was attended by . . . master spotters and seaborne personnel."

In case you are thinking by now that I am condemning all criticism I will explain that as an "A" member from centre, a Spitfire man and a Seaborne "victim," I think I am qualified to say that the "A" man's lot is by no means a happy one. My "rank," as shown above, would put me in the privileged classes according to your correspondents, yet I for one did not get a smell of North Weald. In fact, in our group the centre personnel were not even told of the rally until after it had taken place. Although we had the month's notice which was not given the "B" man, it has not done us much good as we have not heard a word from the authorities since.

Regarding the *Inter-Services Journal*, we have not had the latest issues of that. The last one we saw had a B-29 on the cover and, as far as I know, it was posted to the "B" members. I may be wrong over this last, but I know we haven't seen one since.

As far as visits to air stations are concerned I have done a little better than "Ex-P.B.O.s." I have had two visits to an R.A.F. station where we were permitted to inspect Flying Control Link Trainers, the Parachute Store, and the way out. As far as aircraft were concerned—well, they were Havocs with A.I. and much too secret to let the R.O.C. near.

Perhaps this will soften ex-P.B.O.s' hearts towards the "A" man, who, in this group at least, has no more privileges than the "B" man.

"ANOTHER P.B.(A)O."

Radar Could Not Do Everything

WHILST I heartily agree with the remarks made by "Two very Browned-off P.B.O.s" concerning the sudden collapse of official interest in the Corps, I do not altogether agree with their final remark that "weapons of the V2 type will now make the R.O.C. obsolescent." Whatever robot weapons are developed, there will still be ordinary types of aircraft. You could hardly use V2 for troop transport or photo. recon., and since the original purpose of a war is, on one side, to obtain territory, and on the other to prevent its capture, presumably these transports, etc., will still be required—by one side, at least!

The thing that galls me is that the powers-that-be, including the B.B.C., have never attempted to justify our wartime existence, and are now saying, in effect, that all that we did could be and was done by Radar. But is this so? They say that Radar will identify friend or foe—but it does not; it differentiates between those aircraft fitted with a particular device and those not so fitted, or those whose "device" is not functioning. In other words, if the enemy fitted copies of our device, Radar would, for some time, be rendered useless for this purpose.

It is quite time that officialdom gave us a break; the public regard us as blokes who had an easy job with payment, and did nothing useful in return. It is impossible for us P.B.O.s to convince the public that we did have anything useful to do when Jerry ceased to come over in person. Any mention of the thousands of Allied aircraft in the country—fighters, bombers, trainers, experimental types and captured foreigners—is immediately countered by "What about Radar?" as though Radar even told the operator the name and address of the pilot's girl friend.

I believe that there are still uses in a future war—and perhaps even in peacetime, too—for a similar organisation to the R.O.C., and I do not believe that Radar has in the recent war rendered us entirely obsolete.

Incidentally, the B.B.C.'s story of Radar was all very interesting; you caught an occasional glimpse of the R.O.C. behind certain incidents, but, unless you knew, you thought the R.A.F. did everything.

We don't want praise, thanks or glory, but we would like to convince people of our previous usefulness without contravening the Official Secrets Act. YET ANOTHER P.B.O.

R.A.F. AT PRAGUE: A scene on the airfield at Prague, showing Transport Command Dakotas and Stirlings. Dakotas fly regularly from Croydon to Prague, and the Stirlings are being used to repatriate Czechs from Britain.

SERVICE AVIATION

Royal Air Force and Naval Air Arm News and Announcements

Awards

Naval Air Arm

FOR outstanding courage, determination and skill while serving in H.M.S. *Campania* in escorting a convoy to and from Russia under continuous and fierce attacks by the enemy and in exceptionally hard weather conditions:—

Distinguished Service Order

Act. Capt. K. A. SHORT, R.N.

FOR courage, daring and tenacity, whilst serving in H.M.S. *Searcher*, in air strikes off the coast of Norway under very difficult weather conditions:—

Distinguished Service Cross

Act. Lt. Cdr. R. A. BIRD, R.N.

FOR outstanding courage, coolness and skill in searching out, attacking and sinking an enemy cruiser with a minimum of loss to their own forces:—

Distinguished Service Cross

Temp. Act. Lt. Cdr. (A) M. T. FULLER, R.N.V.R.
Temp. Sub Lt. (A) K. CROMPTON, R.N.V.R.
Temp. Sub Lt. (A) A. E. LANDSELL, R.N.V.R.
Temp. Sub Lt. (A) F. C. OTT, R.N.V.R.

Distinguished Service Medal

C.P.O. (Air) E. J. W. SHERLOCK.
Act. P.O. (Air) A. J. TRAVERSE.

FOR gallantry, skill and marked devotion to duty in air strikes in the Far East:—

Distinguished Service Order

Temp. Lt. (A) A. B. MACRAE, R.N.Z.N.V.R.

Bar to Distinguished Service Cross

Act. Lt. Cdr. (A) T. W. HARRINGTON, D.S.C., R.N.
Act. Temp. Lt. Cdr. (A) D. R. FOSTER, D.S.O., D.S.C., R.N.V.R.

Distinguished Service Cross

Act. Lt. Cdr. T. G. V. PERCY, R.N.
Act. Lt. Cdr. (A) M. S. GODSON, R.N.
Lt. J. DAVIS, R.N.
Lt. R. J. WARD, R.N.
Lt. (A) D. G. RICHARDSON, R.N.
Temp. Lt. C. A. G. ALDCROFT, R.N.V.R.
Temp. Lt. (A) L. F. AUCKLAND, R.N.V.R.
Temp. Lt. J. R. BAKER, R.C.N.V.R.
Temp. Lt. (A) G. T. GRAHAM, R.N.V.R.
Temp. Sub Lt. (A) D. F. HADMAN, R.N.V.R.
Temp. Lt. (A) G. E. HUYTON, R.N.V.R.
Temp. Lt. (A) D. G. JENKINS, R.N.V.R.
Temp. Lt. (A) P. D. C. STREET, R.N.V.R.
Temp. Lt. (A) D. TAYLOR, R.N.V.R.
Temp. Sub Lt. (A) P. B. ADAM, R.N.V.R.
Temp. Sub Lt. (A) J. A. L. ALLDREAD, R.N.V.R.
Temp. Sub Lt. (A) B. BROWN, R.N.V.R.
Temp. Sub Lt. (A) J. A. CHITTLE, R.N.V.R.
Temp. Sub Lt. (A) A. G. CLAYTON, R.N.V.R.
Temp. Sub Lt. (A) R. D. B. DOUGLAS-BOYD, R.N.V.R.
Temp. Sub Lt. (A) W. M. C. FOSTER, R.N.V.R.
Temp. Sub Lt. (A) R. W. HALLIDAY, R.N.V.R.
Temp. Sub Lt. (A) A. S. MACLEOD, R.N.Z.N.V.R.
Temp. Sub Lt. W. A. N. MACKIE, R.N.V.R.
Temp. Sub Lt. (A) I. H. F. MARTIN, R.N.V.R.
Temp. Sub Lt. (A) N. G. MITCHELL, R.N.V.R.
Temp. Sub Lt. (A) R. T. MOORE, R.N.V.R.
Temp. Sub Lt. (A) J. A. PARLI, R.N.Z.N.V.R.
Temp. Sub Lt. (A) G. E. PUGH, R.N.V.R.
Temp. Sub Lt. (A) F. J. RANKIN, R.N.V.R.
Temp. Sub Lt. (A) R. H. REYNOLDS, R.N.V.R.
Temp. Sub Lt. I. F. STIRLING, R.N.Z.N.V.R.
Temp. Sub Lt. (A) W. K. TAYLOR, R.N.V.R.
Temp. Sub Lt. (A) W. THOMSON, R.N.V.R.
Temp. Sub Lt. (A) P. F. H. TOWLE, R.N.V.R.
Temp. Sub Lt. (A) H. A. RHODES, R.N.Z.N.V.R.
Temp. Sub Lt. (A) J. H. RICHARDS, R.N.Z.N.V.R.
Temp. Lt. (A) J. WHYTE, R.N.V.R.
Act. Temp. Sub Lt. (A) D. T. CHUTE, R.N.V.R.

Distinguished Service Medal

C.P.O. W. T. PIRIE.
C.P.O. Airman L. F. BARRICK, C.G.M.
Temp. C.P.O. Airman G. E. COWSILL.
Act. P.O. Airman W. R. CREESE.
Act. P.O. Airman F. GRAINGER.
Temp. P.O. Airman N. E. RICHARDSON.

FOR gallantry, skill and leadership in air strikes in the Far East:—

Bar to Distinguished Service Cross

Act. Lt. Col. R. C. HAY, D.S.O., D.S.C., R.M.

Royal Air Force

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations:—

Distinguished Service Order

Act. Wing Cdr. G. R NOTTAGE, A.F.C., R.A.F., No. 177 Sqn.—Wing Cdr. Nottage has completed much operational flying. He has participated in a very large number of sorties, including many night fighter patrols and has consistently displayed skill and courage of a high order. He has effectively attacked such targets as enemy transport, bridges, railway trucks and some river craft and has inflicted much damage. On one occasion his aircraft was damaged by enemy fire and his navigator wounded. Despite this, Wing Cdr. Nottage skilfully navigated the aircraft back to base and made a safe landing. His ability as a leader and his personal example of initiative and devotion to duty have been well reflected in the operational efficiency of the squadron he commands.

Act. F/O. A. COX, R.A.F.V.R., and F/O. J. A. WAINWRIGHT, R.A.F.V.R., both of No. 463 (R.A.A.F.) Sqn.—One night in April, 1945, these officers and Sgt. Simpson were pilot, navigator and flight engineer respectively of an aircraft detailed to attack the heavily defended oil target at Tonsberg. When nearing the target the aircraft was attacked and severely damaged by an enemy fighter. F/O. Cox and Sgt. Simpson sustained injuries but nevertheless remained at their posts. The nose of the aircraft was shattered and gaping holes were torn in the fuselage. The windows of the pilot's compartment were blown out and much equipment was lost. The bomb sight was rendered useless and it was therefore impossible to bomb the target with any accuracy. The aircraft began to lose

neight and it seemed as though it would have to be abandoned, but F/O. Cox succeeded in regaining control. He then skilfully manœuvred his aircraft to enable his gunners to attack the enemy fighter, which was shot down in flames. Meanwhile, despite suffering intense pain from severe frost bite, caused to their hands by the bitter winds blowing through the open nose of the aircraft, F/O. Wainwright and Sgt. Simpson did everything possible to assist their pilot in his endeavour to fly the crippled aircraft to a friendly airfield. After much difficulty this was eventually accomplished and a skilful landing was made. The coolness, courage and devotion to duty of these officers and airman were an inspiration to their squadron.

Badge of No. 627 Sqn., R.A.F.—"At First Sight."

Distinguished Flying Cross

F/O. T. D GREGORY, R.A.F.V.R., No. 75 (N.Z.) Sqn.
F/O. L. A. GRENON, R.A.F.V.R., No. 10 Sqn.
F/O. S. C. GRIMWADE, D.F.M., R.A.F.V.R., No. 161 Sqn.
F/O. J. W. HUDSON, R.A.F.V.R., No. 83 Sqn.
F/O W. J. LEWIS, R.A.F.V.R., No. 10 Sqn.
F/O. A. LISTON, R.A.F.V.R., No. 115 Sqn.
F/O. K. G. W. MANTOCK, R.A.F.V.R., No. 57 Sqn.
F/O. J. B. MCQUAID, R.A.F.V.R., No. 100 Sqn.
F/O. F. W. MILLS, R.A.F.V.R., No. 640 Sqn.
F/O. H. P. MORTON, R.A.F.V.R., No. 10 Sqn.
F/O. R. B. PHILLIPS, R.A.F.V.R., No. 83 Sqn.
F/O. F. W. POWELL, R.A.F.V.R., No. 640 Sqn.
F/O. J. E. W. PRICE, R.A.F.V.R., No. 207 Sqn
F/O. J. RAYNER, R.A.F.V.R., No. 97 Sqn.
F/O J. K. RONALD, R.A.F.V.R., No. 617 Sqn.
F/O W. SINCLAIR, R.A.F.V.R., No. 463 (R.A.A.F.) Sqn.
F/O. R. H STOW, D.F.M., R.A.F.V.R., No. 158 Sqn.
F/O. D. B. WHITE, R.A.F.V.R., No. 640 Sqn.
F/O. A J. WILLIAMS, R.A.F.V.R., No. 9 Sqn.
F/O. R. H D. WILTSHIRE, R.A.F.V.R., No. 161 Sqn.
Act. F/O. R. DICKINSON, R.A.F., No. 619 Sqn.
Act. F/O. R W. GILLIAM, R.A.F.V.R., No. 195 Sqn.
Act. F/O. W. E. STRANGE, R.A.F.V.R., No. 115 Sqn.
P/O. N. N. BROWN, R.A.F.V.R., No. 102 Sqn.
P/O. C. R. CLARKE, R.A.F.V.R., No. 10 Sqn.
P/O. K. J. FRENCH, R.A.F.V.R., No. 115 Sqn.
P/O. T HEGSELDEN, R.A.F.V.R., No. 35 Sqn.
P/O. B. J. MURRAY, R.A.F.V.R., No. 51 Sqn.
P/O. W. L. REEVES, R.A.F.V.R., No. 619 Sqn.
P/O. A. H. UNSWORTH, R.A.F.V.R., No. 640 Sqn.
W/O. R. A. BARRETT, R.A.F.V.R., No. 100 Sqn.
W/O. H. N. C. WHITMORE, R.A.F.V.R., No. 156 Sqn.
F/O. A. B. MCCALLUM, R.A.A.F., No. 466 (R.A.A.F.) Sqn.
F/O. I. F. PELLAS, R.A.A.F., No. 466 (R.A.A.F.) Sqn.
P/O. K. E. PRYOR, R.A.A.F., No. 186 Sqn.
F/O. R F. DOODY, R.C.A.F., No. 420 (R.C.A.F.) Sqn.
F/O. J. C. FISK, R.C.A.F., No. 626 Sqn.
F/O. K. V. FRASER, R.C.A F., No. 100 Sqn.
F/O. P. C. GREEN, R.C.A.F., No. 420 (R.C.A.F.) Sqn.
F/O. J. HECHTER, R.C.A.F., No. 415 (R.C.A.F.) Sqn.
F/O. A. C. LANGLEY, R.C.A.F., No. 428 (R.C.A.F.) Sqn.
F/O. M. L. MCKAY, R.C.A.F., No. 617 Sqn.
F/O. E. G. METCALFE, R.C.A.F., No. 420 (R.C.A.F.) Sqn.
F/O. J. A. MONTAGNE, R.C.A.F., No. 425 (R.C.A.F.) Sqn.
F/O. D. R. PAIGE, R.C.A.F., No. 625 Sqn.
F/O. R. A. ST. AMOUR, R.C.A F., No. 425 (R.C.A.F.) Sqn.
F/O C. E. SCHONECK, R.C.A.F., No. 10 Sqn.
Act. F/O. H. R. H. MEREDITH, R.C.A.F., No. 158 Sqn.
P/O. A. E. BOON, R.C.A.F., No. 9 Sqn.
P/O. M. J. CAMPBELL, R.C.A.F., No. 419 (R.C.A.F.) Sqn.
P/O. J. H. CLARK, R.C.A.F., No. 419 (R.C.A.F.) Sqn.
P/O. R. S. GRANT, R.C.A.F., No. 419 (R.C.A.F.) Sqn.
P/O. C. W. HOLSTEAD, R.C.A.F., No. 10 Sqn.
P/O. E. HORNE, R.C.A.F., No. 419 (R.C.A.F.) Sqn.
P/O. R. J. JONES, R.C.A.F., No. 626 Sqn.
P/O. J. N. MAGUIRE, R.C.A.F., No. 408 (R.C.A.F.) Sqn.
P/O. A. D. MCINNES, R.C.A.F., No. 432 (R.C.A.F.) Sqn.
P/O W. H. MURRELL, R.C.A.F., No. 419 (R.C.A.F.) Sqn.
P/O. A. MCL. MURRAY, R.C.A.F., No. 158 Sqn.
P/O. J. B. R. PARE, R.C.A F., No. 425 (R.C.A.F.) Sqn.
P/O. W.. RITCHIE, R.C.A.F., No. 419 (R.C.A F.) Sqn.
P/O. R. E. SHIELDS, R.C.A.F., No. 425 (R.C.A.F.) Sqn.
P/O. G. SPRINGHAM, R.C.A.F., No. 158 Sqn.
W/O. E. W. ERICKSON, R.C.A.F., No. 158 Sqn.
F/O. K. L. KELLY, R.N.Z.A.F., No. 619 Sqn.
F/O. G. M. PROCTOR, R.N.Z.A.F., No. 619 Sqn.
F/O. H. W. SHILTON, R.N.Z.A.F., No. 10 Sqn.
F/O. V. G. FITT, R.A F.V.R., No. 102 Sqn.
F/O. J. N. FLETCHER, R.A.F.V.R., No. 625 Sqn.
F/O. W. A. FOOTE, R.A.F.V.R., No. 77 Sqn.
F/O. D. G. GAMBLE, R.A.F.V.R., No. 83 Sqn.
F/O. H. T. GREENWOOD, R.A.F.V.R., No. 214 Sqn
F/O. H. W. GREGSON, R.A.F.V.R., No. 149 Sqn.
F/O. R. E. HARRISON, R.A.F.V.R., No. 10 Sqn.
F/O. C. HART, R.A.F.V.R., No. 102 Sqn.
F/O. R. W. H. HARWOOD, R.A.F.V.R., No. 51 Sqn
F/O. R. HENDERSON, R.A.F.V.R., No. 460 (R.A.A.F.) Sqn.
F/O. C. I. HICKS, R.A.F.V.R., No. 156 Sqn.
F/O. C. HIGSON, R.A.F., No. 466 (R.A.A.F.) Sqn.
F/O. H. W. HOWE, R.A.F.V.R., No. 76 Sqn.
F/O. J. S. JOINER, R.A.F.V.R., No. 625 Sqn.
F/O. H. A. JONES, R.A.F.V.R., No. 15 Sqn.
F/O T. L. JONES, R.A.F.V.R., No. 433 (R.A.A.F.) Sqn.
F/O. W. B. KANE, R.A.F.V.R., No. 115 Sqn.
F/O. J. P. KILPATRICK, R.A.F.V.R., No. 162 Sqn.
F/O. J. LEAKEY, R.A.F.V.R., No. 76 Sqn.
F/O. R. LEARMOND, R.A.F.V.R., No. 195 Sqn.
F/O. C. E. H. MARBAIX, R.A.F.V.R., No. 626 Sqn.
F/O. G. W. MORRIS, R.A.F.V.R., No. 103 Sqn.
F/O. T. MUNRO, R.A.F.V.R., No. 75 (N.Z.) Sqn.
F/O G. A. NAYLOR, R.A.F.V.R., No. 625 Sqn

COASTAL RADAR released. **Now that the war is over, the full story of Radar is being released. This photo shows a Fortress II of Coastal Command carrying A.S.V. (Air to Surface Vessels) aerials on the nose and wings.**

SERVICE

F/O. R. J. NORFOLK, R.A.F.V.R., No. 158 Sqn.
F/O. J. K. NOWEIE, R.A.F., No. 49 Sqn.
F/O. S. C. B. PARKER, R.A.F.V.R., No. 433 (R.C.A.F.) Sqn.
F/O. J. F. PICKARD, R.A.F.V.R., No. 608 Sqn.
F/O. H. D. Y. PRIMROSE, R.A.F.V.R., No. 10 Sqn.
F/O. J. ROGERS, R.A.F.V.R., No. 7 Sqn.
F/O. H. R. SEABLE, R.A.F.V.R., No. 227 Sqn.
F/O. W. J. SHERWEN, R.A.F.V.R., No. 78 Sqn.
F/O. S. SHORT, R.A.F.V.R., No. 156 Sqn.
F/O. D. N. SHRIMPTON, R.A.F.V.R., No. 100 Sqn.
F/O. K. F. SIDWELL, R.A.F.V.R., No. 550 Sqn.
F/O. E. M. SMITH, R.A.F.V.R., No. 550 Sqn.
F/O. S. G. SMITH, R.A.F.V.R., No. 10 Sqn.
F/O. H. E. SNELGROVE, R.A.F.V.R., No. 223 Sqn.
F/O. R. G. SPARKES, R.A.F.V.R., No. 101 Sqn.
F/O. I. C. STAMP, R.A.F.V.R., No. 195 Sqn.
F/O. H. W. J. SWENY, R.A.F.V.R., No. 51 Sqn.
F/O. A. THOMPSON, R.A.F.V.R., No. 35 Sqn.
F/O. G. E. THOMPSON, R.A.F.V.R., No. 195 Sqn.
F/O. J. T. WILLIAMS, R.A.F.V.R., No. 578 Sqn.
F/O. W. WILSON, R.A F.V.R., No. 578 Sqn.
F/O. A. D. WOLFE, R.A.F.V.R., No. 170 Sqn.
F/O. E. W. WOODLEY, R.A.F.V.R., No. 214 Sqn.
F/O. J. A. WOODS, R.A.F.V.R., No. 12 Sqn.
F/O. R. C. YULE, R.A.F.V.R., No. 626 Sqn.
F/O H. G. YOUNG, R.A.F.V.R., No. 427 (R.C.A.F.) Sqn.
Act. F/O. D. A. W. BATTIN, R.A.F.V.R., No. 625 Sqn.
Act. F/O H. F. BIELBY, R.A.F., No. 51 Sqn.
Act. F/O. A. CROMPTON, R.A.F.V.R., No 102 Sqn.
Act. F/O. N. J. CRANE, R.A.F.V.R., No. 153 Sqn.
Act. F/O. R. DICKIE, R.A.F.V.R., No. 466 (R.A.A.F.) Sqn.
Act. F/O. K. R. HAMILTON, RA.F.V.R., No. 195 Sqn.
Act. F/O. J. H. PECK, R.A.F.V.R., No. 227 Sqn.
P/O. C. W. ASHWORTH, R.A.F.V.R., No. 192 Sqn.
P/O. G. L. ASPDEN, R.A.F.V.R., No. 7 Sqn.
P/O. M. H. A. T. BAYON, R.A.F.V.R., No. 128 Sqn.
P/O. S. J. BOWMAN, R.A.F.V.R., No. 7 Sqn.
P/O. D. W. BRIGGS, R.A.F., No. 156 Sqn.
P/O P. G. BULMEN, R.A.F.V.R., No. 77 Sqn.
P/O. F. W. DEEDMAN, R.A.F.V.R., No. 105 Sqn.
P/O. N. C. DEMPSEY, R.A.F.V.R., No. 128 Sqn.
P/O. B. ELSWORTHY, R.A.F.V.R., No. 7 Sqn.
P/O. R. W. C. FITZ, R.A.F.V.R., No. 7 Sqn.
P/O G. FOSTER, R.A.F.V.R., No. 10 Sqn.
P/O. J. FRITH, R.A.F.V.R., No. 7 Sqn.
P/O. J. H. GODSAVE, R.A.F.V.R., No. 460 (R.A.A.F.) Sqn.
P/O. A. N GOULD, R.A.F.V.R., No. 128 Sqn.
P/O. L. A. GREEN, R.A.F.V.R., No. 186 Sqn.
P/O. L. GRIMSHAW, R.A.F.V.R., No. 83 Sqn.
P/O. E. V. GRINTER, R.A.F.V.R., No 51 Sqn.
P/O. M. HARRIS, R.A.F.V.R., No. 460 (R.A.A.F.) Sqn.
P/O. C. C. HILL, R.A.F.V.R., No. 126 Sqn.
P/O. J. T. HOBBS, R.A.F.V.R., No. 77 Sqn.
P/O. J. HOLDEN, R.A.F.V.R., No. 101 Sqn.
P/O. W. T. HOLTON, R.A.F.V.R., No. 158 Sqn.
P/O. E. C. HUGHES, R.A.F.V.R., No. 75 (N.Z.) Sqn.
P/O. C. J. KING, R.A.F.V.R., No. 109 Sqn.
P/O. R. C. JARY, R.A.F.V.R., No. 78 Sqn.
P/O. F. L. LILLEY, R.A.F.V.R., No. 163 Sqn.
P/O. R. H. MARTIN, R.A.F.V.R., No. 7 Sqn.
P/O. A. J. MES, R.A.F.V.R., No. 51 Sqn.
P/O. H. J. MUNNION, R.A.F.V.R., No. 101 Sqn.
P/O. L. A. NOAD, R.A.F.V.R., No. 158 Sqn.
P/O. M. W. PARNHAM, R.A.F.V.R., No. 7 Sqn.
P/O. A. PERRY, R.A.F.V.R., No. 10 Sqn.
P/O. J. C. PICKFORD, R.A.F.V.R., No. 142 Sqn.
P/O. O. J. PRITCHARD, R.A.F.V.R., No. 109 Sqn.
P/O. B. G. ROBERTS, R.A.F.V.R., No. 635 Sqn.
P/O. C. F. ROBINSON, R.A.F.V.R., No. 192 Sqn.
P/O. S. E. G. RORISON, R.A.F.V.R., No. 7 Sqn.
P/O. J. ROTHWELL, R.A.F.V.R., No. 424 (R.C.A.F.) Sqn.
P/O. A. SCHOFIELD, R.A.F.V.R., No 15 Sqn.
P/O. J. W. G. SESSIONS, R.A.F.V.R., No. 158 Sqn.
P/O. L. C. SHARP, R.A.F.V.R., No. 78 Sqn.
P/O. F. C. S. SPINKS, R.A.F.V.R., No. 608 Sqn.
P/O. J. SPRIGGS, R.A.F.V.R., No. 97 Sqn.
P/O. A. H. TAYLOR, R.A.F.V.R., No. 153 Sqn.
P/O. R. F. TRIBE, R.A.F.V.R., No. 158 Sqn.
P/O. E. W. WEARN, R.A.F.V.R., No. 608 Sqn.
P/O. K. M. WILDIG, R.A.F.V.R., No. 166 Sqn.
P/O. G. WILSON, R.A.F.V.R., No. 635 Sqn.
W/O. D. F. CAMERON, R.A.F.V.R., No. 115 Sqn.
Act. Wing Cdr. D. G. HALL, R.A.F.O., No. 236 Sqn.
Act. Sqn. Ldr. R. B. MORISON, No. 89 Sqn.
Act. Sqn. Ldr. T. J. WARNER, R.A F., No. 101 Sqn.
F/O. D W. WESTON, R.A.F.V.R., No. 101 Sqn.
W/O. W. J. CLUBB, R.A.F.V.R., No. 7 Sqn.
W/O. L. COOPER, R.A.F.V.R., No. 158 Sqn.
W/O. H. D. EMERSON, R.A.F.V.R., No. 195 Sqn.
W/O. (now P/O.) D. J. FLOOD, R.A.F., No. 7 Sqn.
W/O. K. R. GOULBOURN, R.A.F.V.R., No. 83 Sqn.
W/O. E. GREEN, R.A.F.V.R., No. 218 Sqn.
W/O. D. HAMILTON, R.A.F.V.R., No. 617 Sqn.
W/O. T. S. HOLMES, R.A.F.V.R., No. 578 Sqn.
W/O. N. W. KARPASSITI, R.A.F.V.R., No. 419 (R.C.A.F.) Sqn.
W/O. G. A. LOVEDAY, R.A.F.V.R., No. 102 Sqn.
W/O. J. S. MCDONALD, R.A.F.V.R., No. 156 Sqn.
W/O. T. MCHUGH, R.A.F.V.R., No. 156 Sqn.
W/O. J. PRICE, R.A.F.V.R., No. 214 Sqn.
W/O. V. G. PROTHEROE, R.A.F.V.R., No. 77 Sqn.
W/O. A. G. SMITH, R.A.F.V.R., No. 10 Sqn.
W/O. R. P. STEEL, R.A.F.V.R., No. 156 Sqn.
W/O. A. R. TAYLOR, R.A.F., No. 149 Sqn.
W/O. F. G. A. WEIGHT, R.A.F.V.R., No. 214 Sqn.

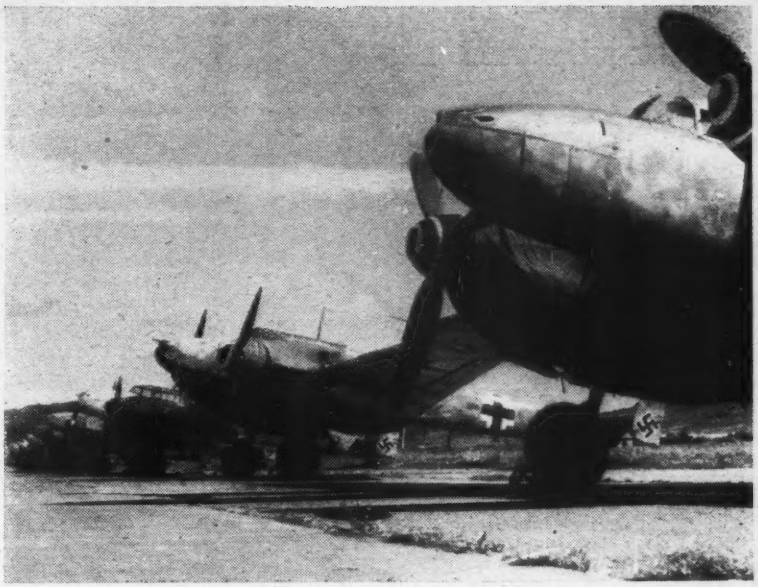
F/O. R. C. FAULKES, R.A.A.F., No. 467 (R.A.A.F.) Sqn.
F/O. J. E. FRANKLYN, R.A.A.F., No. 550 Sqn.
F/O. N. P. GILMOUR, R.A.A.F., No. 466 (R.A.A.F.) Sqn.
F/O. K. F. GUTTERIDGE, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
F/O. K. G. HALL, R.A.A.F., No. 626 Sqn.
F/O. G. H. HARDMAN, R.A.A.F., No. 576 Sqn.
F/O. W. B. KAUS, R.A.A.F., No. 161 Sqn.
F/O. B. J. MATTINGLEY, R.A.A.F., No. 460 (RA.A.F.) Sqn.
F/O. H. R. MCCLELLAND, R.A.A.F., No. 576 Sqn.
F/O. G. B. MCCOSKER, R.A.A.F., No. 466 (R.A.A.F.) Sqn.
F/O. W. J. MOREOW, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
F/O. R. H. NEILSON, R.A.A.F., No. 7 Sqn.
F/O. A. H. NISBET, R.A.A.F., No. 50 Sqn.
F/O. F. I. J. PAGE, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
F/O. A. E. PARRY, R.A.A.F., No. 128 Sqn.
F/O. G. E. RILEY, R.A.A.F., No. 156 Sqn.
F/O. G. H. ROBINSON, R.A.A.F., No. 466 (R.A.A.F.) Sqn.
F/O. C. W. SPURR, R.A.A.F., No. 162 Sqn.
F/O. W. R. UTTING, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
F/O. W. H. WAGENER, R.A.A.F., No. 163 Sqn.
F/O. J. L. WILLIAMS, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
F/O. R. J. WILLIAMS, R.A.A.F., No. 466 (R.A.A.F.) Sqn.
P/O. H. G. ADAMS, R.A.A.F., No. 467 (R.A.A.F.) Sqn.
P/O. F. H. BAYNTUN, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
P/O. D. A. HERRON, R.A.A.F., No. 12 Sqn.
P/O. J. D. LEWIS, R.A.A.F., No. 163 Sqn.
P/O G. A. MCKEOWN, R.A.A.F., No. 622 Sqn.
P/O. A. E. ROBERTS, R.A.A.F., No. 12 Sqn.
P/O. A. G. WEAVER, R.A.A.F., No. 57 Sqn.
W/O. R. S. LEIGHTON, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
W/O. (now P/O.) W. J. MILLER, R.A.A.F., No. 153 Sqn.
F/O. N. B. ELKIN, R.C.A.F., No. 429 (R.C.A.F.) Sqn.
F/O. P. P. ELLISON, R.C.A.F., No. 403 (R.C.A.F.) Sqn.
F/O. K. T. WALLACE, R.C.A.F., No. 156 Sqn
F/O. C. WILBY, R.C.A.F., No. 408 (R.C.A.F.) Sqn.
Act. F/O. J. W. FRASER, R.C.A.F., No. 78 Sqn.
Act. F/O. F. C. HART, R.C.A.F., No. 434 (R.C.A.F.) Sqn.
Act. F/O. H. H. LE CREN, R.C.A.F., No. 76 Sqn.
Act. F/O. W. F. RAYMOND, R.C.A.F., No. 77 Sqn.
P/O. W. L. ANDERSON, R.C.A.F., No. 434 (R.C.A.F.) Sqn.
P/O. L. G. ARMSTRONG, R.C.A.F., No. 78 Sqn.
P/O. W. R. ARNILL, R.C.A.F., No. 408 (R.C.A.F.) Sqn.
P/O. T. MCH. BAIRD, R.C.A.F., No. 528 Sqn.
P/O. W. BODIE, R.C.A.F., No. 433 (R.C.A.F.) Sqn.
P/O. J. E. BOLEN, R.C.A.F., No. 405 (R.C.A.F.) Sqn.
P/O. M. G. BRITTAIN, R.C.A.F., No. 78 Sqn.
P/O. J. C. BURNS, R.C.A.F., No. 405 (R.C.A.F.) Sqn.
P/O. A. CAMPBELL, R.C.A.F., No. 424 (R.C.A.F.) Sqn.
P/O. J. A. CARDIFF, R.C.A.F., No. 77 Sqn.
P/O. L. W. CLARK, R.C.A.F., No. 77 Sqn.
P/O. R. F. CLARK, R.C.A.F., No. 162 Sqn.
P/O. L. FARRELL, R.C.A.F., No. 432 (R.C.A.F.) Sqn.
P/O. S. FERGUSON, R.C.A.F., No. 408 (R.C.A.F.) Sqn.
P/O. J. E. U. GALLANT, R.C.A.F., No. 432 (R.C.A.F.) Sqn
P/O. R. P. HENDERSON, R.C.A.F., No. 432 (R.C.A.F.) Sqn.
P/O. I. G. KERRY, R.C.A.F., No. 432 (R.C.A.F.) Sqn.
P/O. V. G. MARKS, R.C.A.F., No. 635 Sqn.
P/O. K. F. PALLETT, R.C.A.F., No. 424 (R.C.A.F.) Sqn.
P/O. A. J. PERRY, R.C.A.F., No. 7 Sqn.
P/O. T. J. F. QUIGG, R.C.A.F., No. 419 (R.C.A.F.) Sqn.
P/O. J. C. SCHWANDT, R.C.A.F., No. 128 Sqn.
P/O. F. A. SCOTT, R.C.A.F., No. 158 Sqn.
P/O. R. A. SCOTT, R.C.A.F., No. 419 (R.C.A.F.) Sqn.
P/O. F. E. TANNER, R.C.A.F., No. 432 (R.C.A.F.) Sqn.
P/O. S. L. UFFELMAN, R.C.A.F., No. 428 (R.C.A.F.) Sqn
P/O G. D. WILSON, R.C.A.F., No. 433 (R.C.A.F.) Sqn.
W/O.2 C. F. L. BLANCHER, R.C.A.F., No. 150 Sqn.
W/O.2 J G. GRAY, R.C.A.F., No. 405 (R.C.A.F.) Sqn
W/O.2 R. E. RANDALL, R.C.A.F., No. 424 (R.C.A.F.) Sqn
W/O.2 A. L. RIBIE, R.C.A.F., No. 405 (R.C.A.F.) Sqn.
W/O.2 (now P/O.) N. W. STROICH R.C.A.F., No. 405 (R.C.A.F.) Sqn.
F/O. A. A. CHANDLER, R.N.Z.A.F., No. 692 Sqn.

Conspicuous Gallantry Medal (Flying)

Sgt. G. W. SIMPSON, R.A.F.V.R., No. 463 (R.A.A.F.) Sqn.—For citation see F/O. Cox, D.S.O.

Sgt. J. G. WHEELER, R.A.F.V.R., No. 101 Sqn.—Sgt. Wheeler was flight engineer in an aircraft detailed to attack the heavily defended target of Bremen in March, 1945. Whilst over the target area the aircraft was hit and damaged by enemy fire. Sgt. Wheeler was seriously wounded in the thigh. Although in great pain this resolute airman concealed the fact until well clear of the target. After receiving attention, he insisted on being allowed to carry on with his duties. Two of the starboard engines had sustained slight damage, but so well did this engineer fulfil his tasks that his captain was enabled to have full use of the four engines throughout the homeward flight. In spite of much physical distress, Sgt. Wheeler displayed outstanding devotion to duty, setting a splendid example to all. This airman has completed a large number of sorties and has invariably displayed a high degree of skill.

Flt. Sgt. G. B. FERGUSON, R.A.A.F., 466 (R.A.A.F.) Sqn.—This airman was the mid-upper gunner in an aircraft detailed to attack Essen one night in February, 1945. When approaching the target much anti-aircraft fire was encountered. Flt. Sgt. Ferguson was struck in the face by a piece of shrapnel which crashed through the Perspex screen round his gun turret. He had sustained a most serious wound. Nevertheless, he would not distract his captain. Making light of his condition, Flt. Sgt. Ferguson assured him that he did not require assistance. Another member of the crew went to investigate, but this brave gunner kept on his oxygen mask to prevent his comrade from seeing the extent of his injuries and reiterated that he was not in need of help. Throughout the bombing run Flt. Sgt. Ferguson remained at his post. When over Allied territory on the way home the captain once more called to his gunner. Owing to congealed blood in the microphone of his mask, Flt. Sgt. Ferguson was unable to reply. The wireless operator was promptly sent to his assistance. When taken from his gun turret and his mask removed, Flt. Sgt. Ferguson's injuries were fully disclosed. A piece of shrapnel, some two inches long, was embedded in his cheek. His upper jaw had been fractured. Several teeth had been knocked out. His face was very badly swollen and the right eye was completely closed. He was suffering intensely. First aid was given at once. So serious was his condition that the captain brought the aircraft down at an airfield in Allied territory so that his brave comrade could receive the medical attention he so urgently needed. Flt. Sgt. Ferguson set a magnificent example of courage, self-sacrifice and devotion to duty.



GERMAN JUNK: Finding a use (if any) for the hundreds of captured German aircraft must be quite a problem for the R.A.F. This photograph shows a row of Me 110's abandoned in Norway.

Roll of Honour

Casualty Communiqué No. 535.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list 188 are second entries giving later information of casualties published in earlier lists.

Badge of No. 174 (Mauritius) Sqn., R.A.F.—"Attack."

Royal Air Force

KILLED IN ACTION.—Sgt. T. T. Elliott; F/O. R. E. Heap; F/O J. Kilroy; Sgt. W. McMarth; Flt. Sgt. K. V. Rees; Flt. Sgt. B. Robson; Act Flt. Lt. K. Shaw.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt Sgt. A. W Cox; F/O W. T. David; W/O. G. K. Gritty; Sgt. A. S. McLaren; F/O. A. O Mann; Sgt. S. R. Russell; Act. Flt. Lt J. K. Stewart.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. L. E. Amos; F/O. C. Ashcroft; Flt. Sgt. H. I. Austin; Flt. Sgt. R. F. Bayley; Sqn. Ldr I. W. Bazalgette, D.F.C; Sgt. N. Beswick; F/O P. D. Blackham; P/O. D. E. Blockley; Sgt. A Bradley; Sgt. J. V. Bramhall; Sgt. R. H. C. Burgess; Sgt S. C. J. Butcher; P/O. R. R. Cagienard; Sgt. J. W. Cameron; Sgt. J. Chandler; Sgt. R. Claxton; Sgt. S J. Clayton; Sgt. R. E. Collier; Sgt. L. P. Croom; Flt. Sgt. F. T. Cross, Sgt. J. C. Cumming; Sgt. G. Cunningham; Sgt. J. R. Cursiter; Sgt. T. Davenport; Flt. Lt. R. L. F. Day, D.F.C.; Sgt. A. E. Dicken; Sgt. C. C. Dowse; Sgt. R. Elcombe; Sgt. J. P. Ewing; P/O. S. Findley; Sgt. H. T. G. Flint; Sgt. F A. Forster; Sgt. T D. S. Fraser; Sgt. E. Gledhill; Sgt. E. A. Goss; Sgt. P. F. Gough; Flt. Sgt. A. W. Green; W/O. S. Greig; Sgt. J. L. Hamilton; Sgt. D. Hancock; Sgt. F. Harrison; Flt. Sgt. S. Hawes; Sgt. H. S. Hayward; F/O. A. G. Heron; Flt Lt. I. A Hibbert, D.F.C.; Sgt. L. W. Hillman; Flt. Sgt. H. W. Hobden; Flt. Lt. C. Holland; Sgt. H. Idle; Sqn. Ldr. R. S. Jephson; Sgt. H. T. Jones; Flt. Lt. I. T. Jones; Sgt. C. R. Kemp; Flt. Sgt. S. E. Kirkland; Sgt. L. E. Lamb; Flt. Sgt. R. E. Leatham; Sgt. J. Lewis; Sgt. E. C. P. Lloyd; F/O. W. Lowe; Sgt. H. C. Luton; Flt. Sgt. L. R. Lutwyche; F/O. W. Lynam; F/O. A. G. McCarthy; P/O. D. McGregor; W/O. W. S. M. McKean; F/O. M. L. Morgan-Owen; Sgt. F. H. Patten; Sgt. K. Pearton; Sgt. J. G. Pettifer; Sqn. Ldr. C. W. Poulter; Flt. Sgt. F. J. W. Quinn; F/O. W. H. C. Ramsay; P/O. B. Ramsden; F/O. J. J. Read; Flt. Sgt. L. R. Richards; Flt. Sgt. D. J. F. Rivett; Sgt. D. B Robertson; Act. Flt. Lt. J. I. Rogerson; Flt. Lt. P. J. Rossington; P/O. B. Salt; Sgt. D. B. Sheehan; P/O. A. W. Shinn, D.F.C.; Sgt. R. E. Smith; Sgt A. A. Snook; F/O. J. B. Stanley; Sgt. P. T. Stevens; P/O. R. H. Stewart; Flt. Sgt. F. H. Stokeld; Sgt. V. C. A. Stokes; Sgt. A. D. Tetley; Sgt. J. H. Thomas; Sgt. J. W. Thomas; Flt. Sgt. D. M. Turner; Sat. T. M Twomey; Sgt. E. Usher; Sgt. L. R. Vale; Sgt. A. Walker; P/O. A. Warren; Flt. Sgt. L. R. Watts; Flt. Sgt. J. D. Wells; Flt. Sgt. R. S. Williams; Sgt. J. W. Willson; Sgt. A. G. Wright; Sgt. L. H. Wyness.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Sgt. J. G. Durham; Sgt. T. Holmes.

MISSING, BELIEVED KILLED IN ACTION.—Act. Sqn. Ldr. B F. G. Darby; Sgt. R. H. Twin.

MISSING.—Flt. Sgt. D. D.

SERVICE AVIATION

Adam; Sgt C. H. Bartlett; Flt. Sgt. T. L. Benson; P/O. L. Carter; Sgt. F. C. Danvers; P/O. R. E. Davenport; Flt. Sgt. T. W. Doggart; Sgt. C. A. Ebbs; Flt. Sgt. F. Fearnley; P/O. J. G. Forsyth; Sgt. A. C. Fox; Sgt. W. G. Gedge; Sgt. I. Giles; Flt. Sgt. D. H. Hadlow; Sgt. C. J. Hance; P/O. P. J. Hargreaves; Flt. Sgt. G. W. Hatton; Flt Sgt. H. T. Hayes; Sgt. D Heeley; W/O. J Henderson; Flt. Sgt. F. H. Heron; Flt. Sgt. S. Hodgson; Sgt. M. M. Howe; Sgt. B. C. Johnson; F/O. A. N. Lacey; Flt. Sgt. V. W. Lambert; Flt. Sgt. R. L. Leavers; F/O. C. M. Leisk; Sgt. A. Lockett; Flt. Sgt H. McC. McClymont; Flt. Sgt. K. R. Marston; Flt. Sgt. S. J. V. Maton; F/O. H. V. Miller; Sgt. D P. O'Keefe; Flt. Sgt. F. B. Palmer; Flt. Sgt. H. W. Parker; Sgt. N. Peckham; P/O. J. Pickup; Flt Sgt. J. O. S. Picton; Sgt. J. F Plant; Flt. Sgt. G. Platts, D.F.C.; Sgt. J. H. Porter; Sgt. A. K. Rayner; Sgt. K. Relton; Sgt. A. Reilly; Sgt. W. A. Salisbury; Sgt. J. J. Samuels; Sgt. J Sinclair; Flt. Sgt. J. C. Smith; Flt. Lt. A. D. Stephen; Flt. Sgt. W. S. H. Tandy; Sgt. H. W. Tasker; Flt. Lt. E. R. Thornton; Sgt. W. Thornton; Flt. Sgt. W. C. J. Turner; Act. Flt. Lt. K. Usher; F/O. D. L. Venning; Sgt. D. Wager; Flt Sgt. F. A. Wall; Sgt. W. J. Watson; Flt. Sgt G. Williams.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—F/O. L. R. Hannah; P/O. D. Johnston. Flt. Sgt. T. Pantry; P/O. J. W. C Reeve; Sgt. E G. Waters; F/O. J. P. Watkins.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED ON ACTIVE SERVICE.—L.A/C A Camp.

DIED ON ACTIVE SERVICE.—Cpl. A. C. Cribb; Act. Cpl. J. F Diamond; W/O. W. A. Oates; P/O. S. J. Simmonds; L.A/C. R. Widman; F/O A. J. Williams.

Royal Australian Air Force

KILLED IN ACTION.—Flt. Sgt. K. C. McGinn.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. H. C Caswell.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. A. A. W. Berryman; W/O. M. M. Bettington; Flt. Sgt. E. H. Birch; Flt. Sgt. J. S. Boden; Flt. Sgt. F. P. J. Brady; P/O. R. E. Butt; P/O. R. L. Clark; Flt. Sgt. J. Dansie; W/O. G. R. De Fraine; W/O. V. Dickson. Flt. Lt. H. Elms; P/O. J. Finch; Flt. Sgt J. M. Green; Flt. Sgt. K. C. Green; W/O. M. A. Hines; Flt. Sgt. R. P. P. Holden; Flt. Sgt. N. G Huggett; Flt. Sgt. R. A. Ince; P/O. D. J Irving; W/O. F. E. James; W/O. S. G. R. King; P/O. F. J. Knight; Flt. Sgt. M. MacD. Lack; F/O C. N. Lamb; Flt. Sgt. N. J. Lees; P/O E. J. Lincoln; P/O J. F. Martin; Flt. Sgt. R J. W. Moore; Flt. Sgt. J. B. Newman; Flt. Sgt. P. F. O'Connell; Flt. Sgt. I. A. Rands; F/O. W. F. H. Rattle; Flt. Sgt. J. E. Richards; P/O. A. L. Smith; P/O. H. W. J. Smith, D.F.M.; F/O. N. J. Smith; W/O. J. E. Stapleton; Flt. Sgt. A. A. Summers; F/O. W. R. Tanner; P/O. N W. F. Thackray; Flt. Sgt. R. S. Westerman; Flt Sgt. L. W. Zingelmann.

BOMBER COMMAND AT PEACE: Troops in Italy boarding a Lancaster bomber on Pomigliano airfield, near Naples. The journey back to England takes 6-7 hours.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—F/O. N. H. Port.

WOUNDED OR INJURED IN ACTION.—Act. Flt. Lt. G. M. Blumer.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt P. F. O'Donohue.

MISSING.—F/O. F. S. Farren; Sgt. L. L. Hall; W/O. J. J. McNally.

Royal Canadian Air Force

KILLED IN ACTION.—F/O V. R. Bell; Flt. Sgt. C. G. Davidson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—W/O. J. R. Chapman; P/O. T. W. Fair; P/O. A. G. Holke; W/O. R. J. Lawrie; W/O. R. J. Montgomery; F/O. K. J. Murphy; P/O. J. C. Roach; F/O. E. R. Rognan; P/O. I. A. Weir; P/O. R. D. Weller; P/O. W. H. Young.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—P/O. J. J. Milne; P/O. W. L. Moxley.

MISSING.—Flt. Sgt. R. W. Abrams; Flt. Sgt. J. M. Atchison; F/O. H J. Beaton; F/O. B. F. Boyle; F/O. W. A. Brydon; F/O. J. Buckmaster; F/O. A. V. Cash; Flt Lt. W. D. Corbett, D.F.C.; P/O. H. J. M. J. D'Avril; F/O. J. J. A. L. Desbiens; Flt. Sgt. W. W Dewar; F/O. G. W. Exel; F/O. H. J. Feldhans; F/O. R. E. Fennell; F/O. L. Flack; F/O. R. S. Goddard; F/O. M. F. Griffin; Flt. Sgt. R. B. Gunderson; Flt. Sgt. H. Guttormson; Flt. Sgt. H. R. Harris; W/O. L. W. Harvey; Flt. Sgt. H. L. Henderson; P/O. J. W. Hickson; Flt. Sgt. A. Johnston; F/O. C. J. Jones; P/O. J. J. M. Kastner; Flt. Lt. J. G. Kirkpatrick; W/O. J. A. H. Larson; F/O. V. P. McAllister; W/O. C. B. MacDonald; Flt. Lt. G. M. S. McMorran; Flt. Sgt. J. T. J. Magee; Sgt. A. E. Minguet; P/O. J. R. Morin; P/O. L. J. Parent; F/O. N. Peters; Flt. Sgt. G. J. Phillips; F/O. S. A. Reid; P/O. C. J. Roberts; Flt. Lt. D. A. Ross; F/O. C. J. Rouse; F/O. S. L. Saxe; F/O. F. E. Seaby; F/O. M. Shatzky; F/O. R. E. Stillinger; P/O. G. N. Ware; F/O. H. McA. Weaver; F/O. W. E. Weber; W/O. L. W. Webster; F/O. R. A. Young.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. J. R. Baxter; Flt. Sgt. R. F. C. Reaume; W/O. R. F. Schimmens.

Royal New Zealand Air Force

KILLED IN ACTION.—F/O. H. C Maria.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. E. J. Goodyer; Act. F/O. J. K. McRae; P/O. G. W. Paterson; Flt. Sgt. T. C. Potts

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—F/O. B. C. Tasker.

MISSING.—F/O. G. Stewart; P/O. J. W. Winstone.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. G. L. R. Marchant; Flt. Sgt. J. R. Vogt.

DIED ON ACTIVE SERVICE.—Flt. Sgt. J. M. Yates.

South African Air Force

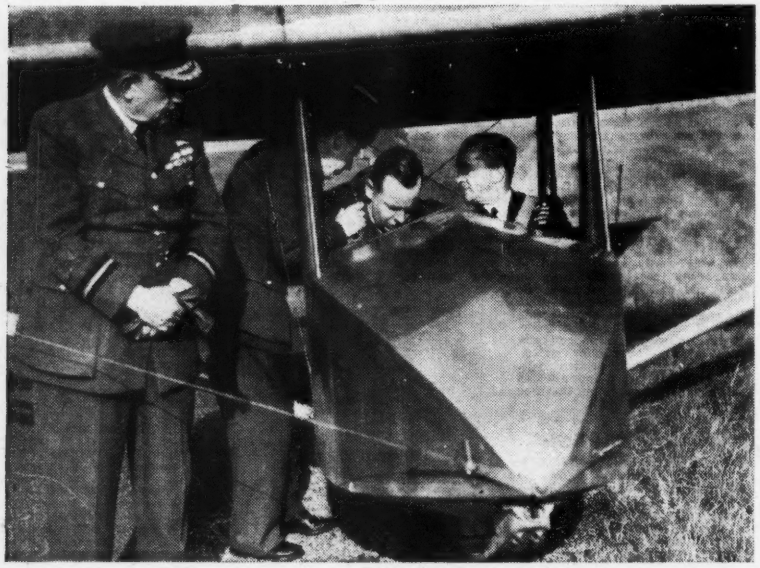
KILLED IN ACTION.—Lt. P. B. Somerset; Lt. D. B. Tattersall.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—2/Lt. P. J. C. V. G. Watteyne.

MISSING.—W/O. F. C. Howe; W/O. A. J. Kruger; Lt. R. Perkins; Lt. G. H. Rylands; Flt. Sgt. S. L. Segal; Lt. L. Senior; W/O. K. H. D. Taylor; 2/Lt. A. Warmback; 2/Lt. T. R. Warner; Flt. Sgt. B. Wicks

KILLED ON ACTIVE SERVICE.—2/Lt. K. B. Hamm; Sgt. W. J. Prinsloo.

DIED ON ACTIVE SERVICE.—Air Mech. S. D. Pearce.



NAVAL GLIDING: A new Naval gliding school was recently opened at Stratton. On this occasion Vice-Admiral Sir Denis W. Boyd went for a six-minute flight in a Falcon, piloted by Flt. Lt. C. L. Faulkner. Air Comdre. Guilfoyle looks on while the occupants of the glider are strapped in.

Official Corrections

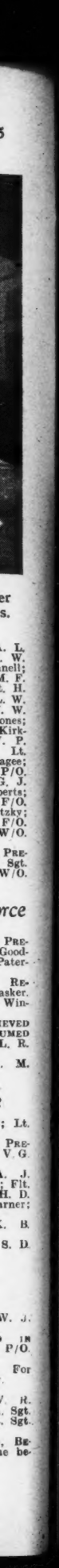
Casualty Communiqué No. 532.

Under "KILLED IN ACTION," for Sgt. W. J. Pullan read Flt. Sgt. W. J. Pullan.

Under "MISSING, BELIEVED KILLED IN ACTION," for F/O. J E Sweetman read P/O. J. E. Sweetman.

Under "MISSING" delete F/O. W. Jessop. For Sgt. D. Moroney read Flt. Sgt. D. Morony.

Casualty Communiqué No. 533.

Under "MISSING" delete Flt. Sgt. W. R. Clydesdale, Sgt. R. Gamble, Sgt. J. McBeth, Sgt. R. C. Pain. For Sgt. J. L. Kerr read Flt. Sgt. J. L. Kerr.

R.A.A.F.—Delete the heading "MISSING, BELIEVED KILLED IN ACTION" and the name beneath.